Marine Engineering
and Shipping Age

Volume XXVIII **March, 1923** **Number 3**

Published Monthly by
ALDRICH PUBLISHING COMPANY
In Conjunction With
SIMMONS-BOARDMAN PUBLISHING COMPANY
Woolworth Building, New York

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"Let's Go!"

WHETHER or not the subsidy bill is passed at this session of Congress, the fact remains that we own the second largest merchant marine in the world and this fleet, on the average, consists of newer and more up-to-date vessels than those of any other country. We might as well make up our minds that these ships, with the exception of four or five hundred of an inefficient type, are not going to be abandoned or scrapped. If we do not operate them, there are others that will, even if they are compelled to do so under the American flag.

We have witnessed, as explained in another editorial in this issue, how one of the largest shipyards in England has established itself in the repair business in New York harbor. But listen to this reported quotation of Sir William Reardon-Smith in a recent issue of *Fairplay*: "Incidentally, he also stated, that his personal representative in the United States, Mr. W. C. Liley, had taken out citizenship papers with the ultimate view of establishing an American subsidiary of the Reardon-Smith Line and purchasing ships for operation under the United States flag; that he believed that these vessels could be operated as cheaply or nearly as cheaply as our British steamers, and will have an advantage of low initial cost and other considerations." Will it be necessary for us to pass through the humiliation of seeing foreign shipowners come over here and show us, under the guise of intended citizenship or some other subterfuge how to run our own ships? "Let's go!"

The Ship Repair Work Situation

IN spite of the fact that dry docking charges in the New York district have been reduced to 5 cents a gross ton or practically what they were in 1914, data recently collected by the United States Salvage Association show that the average price of ship repairs, due to the present wage scale and the price of steel, is still about 100 per cent greater than in pre-war days. While the price of dry docking indicates keen competition in this field there are many reasons for believing that the future of the ship repair industry offers opportunities that should not be overlooked.

Although a considerable number of ship repair yards were established in America during the war boom we have still a much smaller proportion of dry dock accommodations per ton of shipping than Great Britain. In 1913 Great Britain had 210 docks for 20,431,500 tons of shipping or about 93,000 tons per dock. There were in 1919 on the coast of the United States 44 docks against a total of 13,000,000 tons of shipping or 295,000 tons per dock. Figures are not available for docks installed since 1919 but we have still a long way to go before our repair facilities per ton of shipping equal those of England.

No doubt the relatively high cost of repairs in American yards has been the controlling reason why so large a proportion of this work has been done on British and foreign vessels at their home ports. Nevertheless at least one firm of British shipbuilders and repairers has shown its confidence in the belief that much more British and foreign shipping might be satisfactorily repaired in the United States instead of deferring the work until arrival in home ports. We refer to Swan, Hunter and Wigham Richardson, Ltd., who recently became associated with the New York Harbor Dry Dock Company of Staten Island, N. Y.

As to the prospects for home work, there is the definite circumstance that practically every American vessel that has been tied up for lack of trade will certainly need overhauling and repair work before it can be operated again. In connection with this, the most probable shipping development in the near future, as explained in another editorial, will be the conversion of quite a number of steamers to motorships.

Still further, the provision of the recently enacted tariff law requiring American shipowners to pay a 50 percent tax

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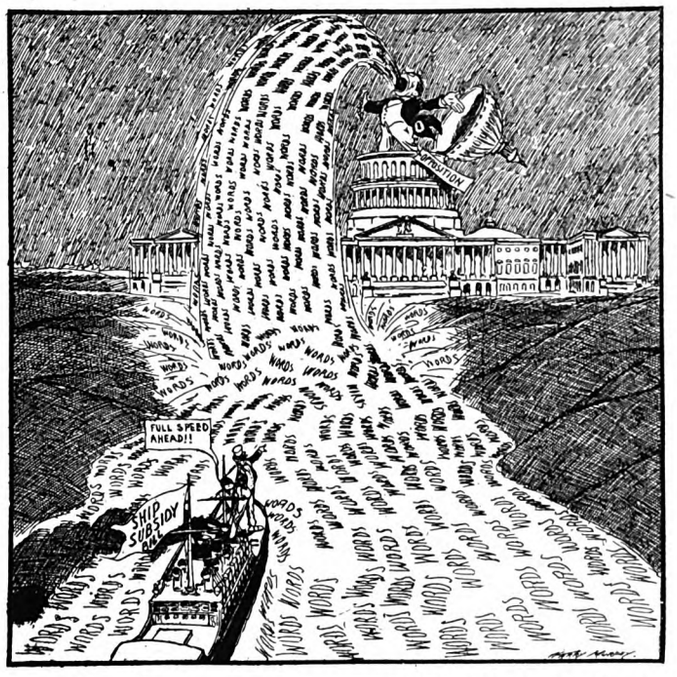
on all except emergency repairs on American vessels reconditioned in foreign yards will have a decided effect.

With British firms considering and establishing repair plants in this country, with the world's surplus tonnage decreasing so fast that a demand must soon be made for our idle vessels and which a protective law relating to repair work on American ships, to say nothing of the probable reconditioning of several large passenger liners, it is safe to predict that the outlook for the ship repair business is decidedly optimistic.

Engineering Abbreviations To Be Standardized

THE American Engineering Standards Committee decided at a conference held on February 13 to undertake the standardization of engineering, scientific and graphical abbreviations and symbols. The successful completion of this project, covering as it does a considerable portion of the language of every technical society, college and industry in which engineering is applied, will require a tremendous amount of work and co-operative effort but, in our opinion, the benefits resulting from the adoption of fixed symbols will pay continuous and permanent dividends in the more rapid and accurate communication and interchange of engineering knowledge.



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Bucking the Flood of Oratory

—Murphy in the *New York American.*

Such a work, however, should not be confined to the United States. Every effort ought to be made to secure the co-operation of every country so that engineering abbreviations would become a universal language just as musical and chemical symbols are today. As shipping is decidedly an international industry we have found it necessary, in order to avoid confusion, to eliminate all abbreviations in the text matter of MARINE ENGINEERING AND SHIPPING AGE except, of course, in formulæ and tabular matter where explanatory notes are added. A striking example of existing confusion may be illustrated by the term "h.p.". Some English journals use this symbol for "high potential" while it is generally used for horsepower in this country. When we get to translations from a foreign language it is still more difficult to be sure of the author's meaning.

However, we do not wish to create the impression that we are advocating this project because it will make it easier for the editors of technical publications. It is of far more importance to students and to engineers whose work requires frequent reference to varied engineering literature. And it is of importance to foreign trade in engineering products because the divergent practice in the use of abbreviations causes difficulty and confusion in descriptive translations.

Important Motorship Developments Started

THE conversion of idle Shipping Board tonnage to motorships will, in all probability, be the next important development in the shipbuilding industry. Admiral Benson has already held two conferences with the representatives of shipyards and Diesel engine manufacturers with a view to stimulating this project, and a third conference is to be held at Philadelphia in the near future. The Shipping Board is now collecting all available data relating to the characteristics and performance results of its various classes of ships in order that a proper differential in regard to the price of steamers that are to be sold "as is and where is" in distinction to those which are to be sold for conversion may be fixed.

In order to give our readers a clear insight into the possibilities to be obtained by purchasing Government steamers at reduced prices and converting them into motorships, we have asked Professor Lawrence B. Chapman of Lehigh University to make a careful comparison of the Government steamers as steamships and as converted to motorships. The analysis appears elsewhere in this issue and it will be noted that it includes every operating cost so that the prospective shipowner may ascertain exactly the rate at which he can afford to carry a ton of cargo. It will also be noted that the price that he must pay for the steamship or motorship, ready for sea service, is a vital factor and also one that cannot be given too careful consideration in choosing between the steamship and motorship.

In connection with the figures given in Professor Chapman's article, we recommend that our readers study the data relating to the comparative costs and weights of steam and Diesel machinery given in the paper entitled "Selection of the Best Type of Propelling Machinery," which was read before the last meeting of the Society of Naval Architects and Marine Engineers and which we are publishing in this issue.

Although the Shipping Board has not fixed the differentials that it will make in the price to be charged for those vessels that it will sell as steamers and those it will sell for conversion, the figures given in Professor Chapman's analysis can easily be modified to fit the amounts finally adopted. Then it will be advisable to check the costs of the Diesel installation and the auxiliaries for if a number of vessels that are practically sister ships are to be equipped with the

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same powered engines and the same size auxiliaries it will probably make a decided difference in the initial costs.

This is probably what will happen, for the Government vessels suitable for conversion may be divided into three or four classes and the Shipping Board is considering the advisability of appointing an expert committee to standardize the sizes of engines, motors, pumps and other auxiliaries so that prospective purchasers may be furnished with standard specifications that will have the approval of an authoritative body. As may be easily seen, such specifications would have a decided effect on the price of electrically driven auxiliaries.

Another matter that should not be overlooked in deciding between the steamer and the motorship is whether or not the steam installation in the existing vessel is what it should be. Professor Chapman has assumed an economically designed steam installation but it is a known fact that the machinery in many Shipping Board vessels does not fit the characteristics of the ships.

When the Shipping Board completes its investigations, however, there can be no reasonable doubt that the Diesel installations specified will represent excellent practice both as to main and auxiliary power. Thanks, therefore, to the surplus Government-owned tonnage, it will be possible to obtain the best type of motorship cheaper in America than anywhere else in the world, and this, in our opinion, is a good and sufficient reason to believe that important developments along this line will occur in the near future.

Adoption of Uniform State Marine Insurance Laws Recommended

THE Chamber of Commerce of the United States has sent out a circular letter under date of February 10 recommending the adoption by the various states of uniform marine insurance laws based upon the underlying principles of the Model Marine Insurance Act of the District of Columbia. State legislatures should give this recommendation their earliest attention because American marine insurance companies are meeting foreign competition with the greatest difficulty due both to the conflicting laws of the states and to unjust restrictions and handicaps.

Congress realizing the injustices of these conditions passed the model insurance bill hoping that the several states would modify their laws to conform to it. The fundamental ideas of the bill are as follows: To provide greater freedom on the part of American companies to co-operate through syndicates and mergers. To establish the multi-field insurance principle, so that American fire, marine and fire-marine insurance companies may be free to transact all kinds of insurance other than life. To substitute a system of net profits taxation in place of the system of taxing gross premiums. To enlarge reinsurance facilities. To remove the limitations on the financial powers of companies which hamper operations in foreign fields.

It appears self-evident that there is no logical argument against the adoption of a uniform marine insurance law within the nation providing, of course, that a good model to work on is available. And, in this connection, we are glad to be able to say that the Committee on Merchant Marine and Fisheries of the House of Representatives in preparing the Model Insurance Bill of the District of Columbia made a very thorough and exhaustive investigation of the whole subject having in mind the fact that they were forming a basis for the states to follow.

Missing Our Great Opportunity

THE Department of Commerce reports that the idle tonnage of the world has been reduced by 2,000,000 gross tons during the year 1922. American merchant ships, however, have failed to make any gain, the idle tonnage as of January 1, 1923, being 4,411,000 gross tons as compared with 4,314,000 gross tons on January 1, 1922.

England in the meantime has reduced her idle vessels by 951,000 gross tons and her shipowners have recently placed substantial orders for new ships. This shows that there is not the world surplus of efficient vessels that insidious propaganda would lead us to believe. In fact, of the 8,955,000 tons of idle tonnage remaining, approximately half of which is tied up in our rivers and harbors, the American vessels alone practically represent the ships that are not obsolete and unfit for competition in the world trade.

The answer is that shrewd English shipowners are aware that the price of new construction has reached a minimum and that world trade and conditions in general are getting better. The prompt acceptance of the terms laid down by the American Debt Commission by the British Government and the fact that this settlement will probably be endorsed by the American Congress by the time that this editorial is printed should have a far-reaching effect on business stability both here and abroad.

What are we going to do about it? Are we going to continue to sell the world short, are we to sit quietly by and watch an inflation of domestic business without providing a governor in the shape of increased foreign trade and American ships to carry it in for the surplusage of our products that is bound to accrue? The Shipping Board will sell first class ships as cheap if not cheaper than they can be bought anywhere in the world, a great subsidy in itself. It has paid for the education of a number of operators and made them agents for the cream of the fleet. Every reasonable request for equipment or fittings that would increase the economy has been provided at the country's expense. All that is lacking is a definite constructive policy on the part of the Government.

Now if Congress evades a decision on the shipping bill at this session, the Shipping Board, knowing that no one has any business to operate Government ships unless he intends eventually to become their owner, should definitely establish a policy not to parallel routes covered by privately owned lines and then it should put the same energy that it has expended in trying to secure favorable legislation into forcing the operators of Government tonnage who have been nursed along through the depression to become financially interested in the vessels that they are running.

The fact that the world's idle tonnage is rapidly decreasing is a strong indication that shipping is on the upturn. If we allow ourselves to become discouraged at the procrastination of Congress, we will miss the greatest opportunity this nation has ever had to assume the commercial and moral leadership of the world.

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Give American Shipping a Square Deal!

Why Single Out Shipping and Shipbuilding Among All the Industries of the Country to Be Without Protection?

By "Old Scotch"

A FRIEND recently, in discussing outstanding events in his life, described his saddest experience. It appears that he was orphaned at the early age of six, and was taken over by a relative to raise. Arriving at his new home in November, it was not long thereafter that he attended the Christmas Eve festivities at the Sunday school to which he had been affiliated. The Christmas tree was brilliantly lighted, and laden with presents for both young and old. Laughter, song and joy reigned supreme as customary on such occasions.

As the religious ceremonies were completed, the superintendent in a resonant voice called out the names of every scholar and teacher, and, amid applause, some appropriate gift was handed to each. The one exception in this entire audience was this poor little 6-year-old orphan, whose name had been overlooked either purposely or accidentally, it matters not which, so far as his feelings were concerned. Imagine what thoughts were flashing through that poor child's mind as he wandered home that Christmas Eve in the snow. He told me that for years his mind was embittered by the memory of the overwhelming injustice placed upon him that evening.

Are the shipping interests in this country to be placed in the mental attitude of that poor 6-year-old orphan? is the question now up to the Senate of the United States. Are we in years to come to be embittered against our own Government for singling us out among all the industries of this broad land to be the step-child and helpless orphan? Gentlemen of the Senate, the bare facts of the helplessness of the shipping interests in conducting the foreign trade of this country have been placed before you. In spite of many efforts to camouflage the real situation, you cannot, if you believe in a square deal, sidestep the issue.

Limited Expenditure Will Retain Great Sums in this Country

Such wild statements as: "The pending bill is designed to turn over $750,000,000 to the Shipping Trust" do not go with an enlightened public. You know in your minds that such is not the fact. You have already limited the total expenditures to $30,000,000 a year for a period of ten years, and you know that there is no such thing as a shipping trust in this country. If you will reverse that statement and say that the defeat of this bill will turn over $750,000,000 of the money of your constituents to foreign shipping trusts in the next ten years, you will be approaching the truth, except the amount involved will be perhaps three times that sum. You know from your own Congressional investigations that there is a very potent trust in foreign shipping, and you also know from the same investigations that there is nothing even resembling a trust among the shipowners of your own country.

You know that this term "subsidy" which is not even used in the shipping bill, but only used by the critics of the measure, is nothing more nor less than a protective tariff applied to the shipping industry, and that it is the only practicable method of giving protection and encouragement to the merchant marine.

Only Sufficient Protection to Compete with Foreign Interests Required

Is there any out and out free-trader in your ranks? My impression is that every one in this country believes in a tariff to protect the industries in which he is interested be they agricultural, mining or manufactured products. The only differences on the subject of the tariff, between the two great political parties, are in the relative protective rates needed to allow different industries to compete with like industries abroad.

The old economic saw of: "Let him who does it cheapest do our work," does not apply in any branch of American industry which has to compete with foreign output. It is un-American and contrary to our policies which have made us the richest nation on earth. Is it possible that you want to single out our merchant marine as the lone "orphan" upon which to apply this anti-American policy of sink or swim according to economic conditions?

All protective policies which we have introduced in this country have paid indirectly in the building up of the general prosperity of the country. Our merchant marine in its present condition will, if this bill is enacted, pay vast dividends in increased trade abroad beneficial to farmer and manufacturer alike, besides keeping millions of dollars at home for the freight and insurance moneys which must otherwise go abroad to our rivals. In addition, do not overlook the fact that it will actually save money to the Treasury, and that *direct* taxes will be reduced rather than increased.

This proposition is as simple as A B C, yet it has not been properly explained to your farmer constituents. The very fact that an annual sum of $30,000,000 expended as a protective tariff to shipping, making it possible for Americans to operate many of our idle ships, will give us a market for the sale of these ships, which otherwise must swing idly at their moorings and become disintegrated by the ravages of time. The enhancement in value of these otherwise idle ships will put in the Treasury at the lowest calculation not less than two dollars for every dollar invested in the annual reserve tariff paid to the shipowner.

Was there ever a better straight-out business proposition put up to the American taxpayer?

Where is there a farmer or a tradesman in this country who would not immediately embrace an opportunity of this kind in his own business?

Shipping Bill Misrepresented

In conversation with several friends who have recently made trips through the farming communities of the said West, I learn that there is an alarming condition among the citizens there on account of their inability to pay the huge taxes placed upon them by the federal, state and local authorities. They have been taught that this so-called "subsidy" bill is another great increase in their federal taxes. Naturally, like instituting economy among your wife's relatives, they immediately clamor for reform in the industry which they think affects them the least. Tell them the unvarnished truth about this shipping situation, let them know that this bill is a saving and not an additional expenditure, and their good common sense will bring their approval to your action in voting for this measure.

Tell the farmers in the South of the statement made by one of their great senatorial leaders, that the lack of American ships in 1914-16, cost them over one billion dollars in cotton alone.

Tell them also of the two authoritative statements issued

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by competent authorities within the past week. The first is that the world's shipping business has increased, as evidenced by the fact that there were over 2,000,000 tons less of idle ships in the world on January 1, 1923, than there were on the corresponding date one year ago. The United States was alone in having more idle ships than in the previous year. The second statement is that American exports actually decreased over $650,000,000 during the year 1922. Couple these statements and use your own logic as to the ultimate result for our American industries.

COST OF SUFFICIENT MERCHANT MARINE LESS THAN PRESENT FIASCO

There has recently been appropriated the sum of $50,000,000 to pay the losses of Government operation of merchant ships, and to care for the laid-up ships. Compare this to the sum of $30,000,000 which is proposed to aid a sufficient merchant marine when placed in private hands. Let the farmer constituent consider that difference when he moodily contemplates his ever rising tax bill.

Assistant Secretary Roosevelt, a chip of the old block, recently stated in a public address, just what his illustrious father has often stated, that our national safety depends upon the maintenance of a sufficient merchant marine just as much as it does upon the fighting ships of the Navy. They are inseparably linked, each dependent upon the other. Can we fight for our national safety with only one leg upon which to stand?

Shorn of all technicalities, the foregoing are statements of the underlying facts in connection with the shipping problem now before the Congress of the United States. Can a tenable argument be given as to why the bill should not be enacted into law? Many misrepresentations have been brought forth but they cannot withstand the logic of bare facts. A rising tendency towards Government ownership and operation is in evidence, but our experience with the railroads in war times should be sufficient to steer us clear of that procedure with shipping.

Weigh these facts and *give us a square deal,* which when conditions are known and matters carefully analyzed is what the American public always demands of its legislators.

Do not treat us like an orphan!

National Merchant Marine Association Holds Fourth Annual Convention on February 7 at Washington

Representatives of Commercial Organizations, Commonwealths and Cities in Convention Assembled Petition Congress for Speedy Action on Shipping Bill

THE fourth annual convention of the National Merchant Marine Association was held in the Rose Room of the Hotel Washington, Washington, D. C., on February 7. Senator Joseph E. Ransdell of Louisiana, president of the association, opened the convention with a stirring address on the tremendous importance of the merchant marine to the American people. He said that it is going to take all the influence of all the business organizations and maritime associations to build up a favorable public opinion in regard to shipping.

"The subsidy bill has the strongest prospects for a speedy passage," Senator Ransdell said, "but, if the bill is enacted into law"—and he believed that it would be—"it will be essential to maintain this association because a clearing house will be necessary to help mold and maintain public opinion. Should the measure fail it will be all the more necessary for the association to conduct an educational program."

NAVY NEEDS THE MERCHANT MARINE

Colonel Theodore Roosevelt declared that civilization is and always has been based on transportation and communication and that the countries that are the highest developed today are those having the best means of communication.

"The outstanding characteristic of the Roman Empire and the primary factor that built it up and held it together was its splendid system of roads and its fleets of galleys."

The Navy, Colonel Roosevelt pointed out, has the prime function of preserving communication by sea. It is also our first line of defense, but the value of a merchant marine from the standpoint of defense has always been recognized. By the limitation of the Navy the importance of the merchant marine is greatly increased, a point brought out by Secretary Hughes at the Disarmament Conference when he said that the importance of the merchant marine is in inverse ratio to naval disarmament.

The merchant marine is a valuable complement to the Navy in furnishing light cruisers and scouts. It maintains in time of peace vessels that otherwise would have to be kept in idleness at great expense for the purpose of serving as colliers and supply ships in time of war. We are not a military nation and without a merchant marine where are we to draw the men to man our warships in time of war when a rapid expansion of the Navy is imperative?

The ship subsidy bill is also necessary in order to maintain our high standard of living, declared Colonel Roosevelt. A republican form of government depends on a high average of citizenship and we want our sailors to share this standard. The merchant marine needs the Navy in time of peace, the Navy needs the merchant marine in time of war, and both are needed by the country at all times.

SHIPPING BILL FROM FARMER'S STANDPOINT

The farmer's interest in the shipping bill was discussed in a speech prepared by Senator Wesley L. Jones, which was read on account of the senator's absence by Winthrop L. Marvin.

The farmer more than any other one class in the country needs the immediate passage of the shipping bill, was the conclusion of Senator Jones. It was essential, he pointed out, that our farm products find markets abroad and that their profitable export depends upon reasonable rates and prompt service.

"If there are no ships," Senator Jones said, "there is no market for this farm surplus and this very fact reduces the price for the whole surplus. If foreign ships alone are available to take his crops, the farmer must await their pleasure or convenience and he must pay such freight as they see fit to charge."

Senator Jones said special appeals had been made to set the farmer against the Shipping Bill, why, he did not know. One of the favorite assertions was that the merchant marine payments would go only to wealthy shipowners—an unnamed and intangible shipping trust.

The great bulk of the merchant marine fund, or subsidy money, Senator Jones said, would go to men who will buy

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or build American ships and run them in competition with already established foreign ships or lines. "It will lead to American transportation instead of foreign transportation for the products of the American farm," he added, "and what American farmer does not think that is a valuable thing to have?

"Not only does it furnish him transportation at reasonable and stable rates, but it establishes shipyards furnishing employment to labor and a market for his products and the employment of capital and labor in many different ways.

"The high rates which the people had to pay before American ships were built, went largely to alien ships owned or controlled by great trusts over which we had no control. If we had built a merchant marine, our farmers and business men would have been saved hundreds of millions of dollars that went into the coffers of these foreign shipowners and would have been saved hundreds of millions of tax burden. In addition, much of this money would have been spent at home in the development of our interests and the employment of our own labor, thereby adding greatly to the domestic market for the farmer's products."

Merchant Marine Necessary for Foreign Trade

Colonel Myron W. Robinson, president of the American Manufacturers' Export Association, declared that if we want to place American goods in the markets of the world then it is necessary to have American ships sailing the seven seas. The whole world, he said, admits that foreign trade is vital, our own people admit it whether they be manufacturers, bankers, farmers or merchants.

The least disturbance on foreign shores today, said Colonel Robinson, is at once shown in our daily business. Our foreign business is much smaller than our domestic business, but still—"It is the tail that wags the dog." Those who read the newspapers of today and cannot see beyond our own shores are certainly near-sighted. It is not only the necessity of foreign trade but the effect of this trade upon domestic business that makes it so essential.

Our economic body must stand on the two legs of transportation, inland and ocean, declared Colonel Robinson. One of these legs, the merchant marine, needs help and that help is the so-called ship subsidy bill. As a matter of fact, all other industries have been generously helped and in each case that aid has been no more nor less than a subsidy.

American Ships Recommend Themselves

Mr. Frank C. Munson, president of the Munson Steamship Lines, spoke of the present service of our passenger vessels. He declared that the combined passenger and freight ships popularly known as the 535's were vessels to be proud of and that they were operated with the highest efficiency, both on the Atlantic and Pacific.

Referring to the subsidy bill, Mr. Munson stated that if that measure fails, our passenger vessels cannot continue to run and also that the freighters running in conjunction with them and their feeder ships will also have to be discontinued. As an illustration of the general lack of faith in Congress supporting American shipping he said that the International Mercantile Marine Company had built a number of ships in British shipyards since the close of the war. Mr. Munson pointed out the present filibuster as evidence of the influence of foreign interests through large amounts of money spent on propaganda.

On the other hand, Mr. Munson believed that the passage of the subsidy bill would make it possible to dispose of a large number of vessels to private owners. He also thought that it would stimulate the conversion of steamers to motorships and, in this connection, he explained that the Shipping Board would appoint a committee of experts to expedite that project and that there would be many who would take advantage of it.

Shipping and Shipbuilding a National Asset

"It is not tolerable that we should, either in peace or war, be dependent on any other nation for our international trade conditions," said Robert Haig, vice-president of the Sun Shipbuilding Company, "and to us, now that naval disarmament is likely to reduce our warships almost to the vanishing point, the necessity of a real mercantile marine is vitally important.

"At all times productiveness in any quarter is governed by the transportation to be obtained," said Mr. Haig, "and where transportation is lacking or inadequate, business languishes, the country's assets are impaired and the people suffer through lack of work, food and fuel. Transportation is the life blood of a nation, and a look abroad will demonstrate how keen the other nations of the world are to maintain and develop their marine transportation.

"Shipping, neither here nor elsewhere," said Mr. Haig, "can not continue unless it is supported by well equipped, up-to-date shipyards, and shipyards will not continue to exist and do good useful work unless they can find employment to sustain the staffs necessary. Shipbuilding is a complex art, requiring for its execution educated and specially trained men. If shipbuilding should be allowed to decline, as it did years ago, these men will eventually drift into other channels and the art and practice of shipbuilding, with all the labor research of years, will be lost."

Mr. Haig said it was abundantly proved that shipyards could not be improvised over night and told of the great work done during the war by the private yards in building and repairing and in training personnel. He pointed out that of all our industries, shipping was the one unprotected one. Mr. Haig then asked why such a vital link in the nation's defense should be ignored.

Subsidy Bill Will Reduce Cost of Operation

Not the least interesting of the addresses delivered at this convention was the speech of the Honorable S. G. McLendon, Secretary of State of Georgia. Mr. McLendon quoted President Harding in his message to Congress, November 21, 1922, as informing the country that our fleet of merchant ships had cost three billions of dollars, that these ships were worth only a fraction of that cost, that in operating less than one-third of our Government-owned ships the people were losing $50,000,000 a year and that, under the bill now pending, this loss would be reduced from $50,000,000 to $20,000,000.

Mr. McLendon declared that it was the first duty of the Government to get rid of the public ownership of any business. It was a Democratic congress, he pointed out, that granted the first subsidy of $400,000 a year to the Collins Line and this aid, he stated, had been sufficient to enable the American line to beat the Cunard Line. The Democrats, he said, were opposed to a ship subsidy now because of inherited prejudices which they should abandon for the good of the country.

Commerce of United States a Treasure House for Foreign Ships

Commissioner Edward C. Plummer of the United States Shipping Board pointed out that for years propaganda in the interest of foreign ships, which had found such a treasure house in the foreign commerce of the United States, had pursued a devious course among our people with little difficulty. Now he said the people were awakened to the vast national interests which this question of an American merchant marine involves, and to the fact that the commercial independence of this country,—to say nothing of our national security—demands an adequate fleet of merchant ships under the Stars and Stripes.

"This growth of American business in South America, which has given much employment to Americans, is wholly—

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mark, I say wholly—due to the fact that since the war we have put American ships into the service between those countries and the United States. There had been ships plying between Brazil and the United States for fifty years, but they were foreign ships, and the foreigners got the business which is now coming to us. That is the statement of Sir John Thornycroft, and surely no opponent of American shipping would think of questioning the word of a titled Englishman!

"Take the case of our services from the Pacific States to the East Coast of South America. Before our vessels were put on that route business there was negligible. We started with freighters and small cargoes. The business sought by the Shipping Board has so developed that already we have supplemented those freighters with combination freight and passenger ships, and the growth of this business, constant and healthy, is of great benefit not only to the people of the United States but to the people of South America whom we serve.

"Adequate water services between two countries are always beneficial to both countries, and what both of our South American lines have accomplished is a benefit to the South American countries served as well as to the United States."

COMMERCIAL AND FINANCIAL SUPREMACY DEPEND ON SHIPPING

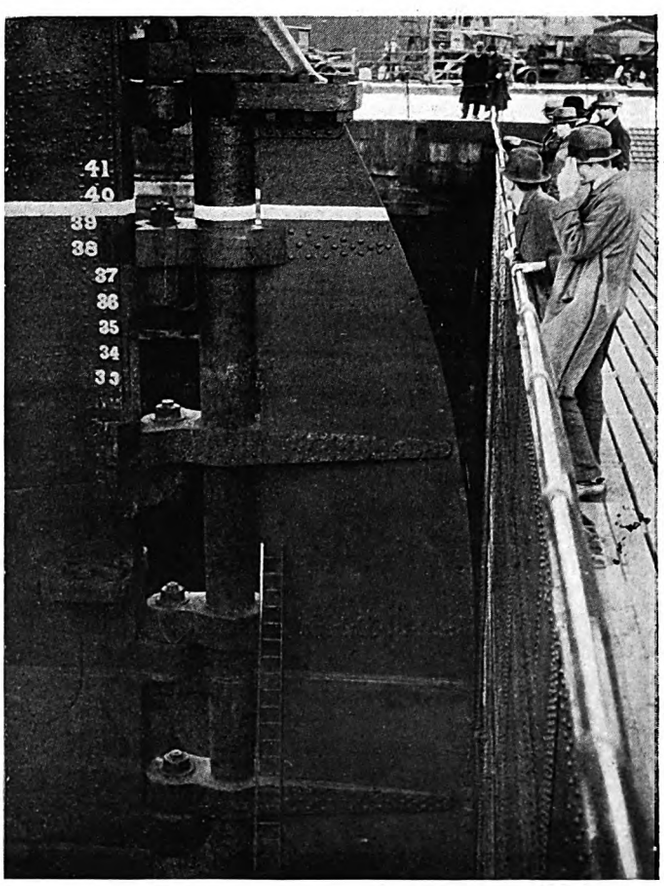
"Command of the seas," declared Congressman George W. Edmonds, "meant in the olden times as it does today; commercial and financial supremacy, and as a consequence marked the most powerful nation. How marked in history are the names of Phoenicia, Carthage, Athens, Rome, Venice, Genoa, Portugal, Spain, Holland and England, for a short time the United States, and again by the indifference of ourselves Great Britain, and how all history of the non-maritime nations sinks into oblivion and fable when compared with our own knowledge of those various 'Mistresses of the Seas.'

"The merchant ships of all nations were not only a safeguard to the integrity of these nations, but were the pride of their people so much so that almost as far back as history exists it will be found that all governments gave every necessary assistance to forward the interests of their merchant marine.

"As an aftermath of the great war," said Congressman Edmonds, "we again find ourselves in possession of a merchant marine, not well balanced in the types of vessels, but beyond question the second merchant marine in tonnage. We find that to operate these ships, as it is believed American ships should be operated, and on account of the higher cost in the United States compared to other nations, and more than anything else on account of the ship subsidies, shipbuilding bounties, preferential railroad rates, high postal subventions, and other assistance paid to their merchant marines by our principal competitors, we are forced either to be in the position of letting our ships lie in idleness, and using other ships for our carriage or of giving to our ships such assistance as we find necessary to equalize the differences.

"It appears that owing to unfortunate scandals which have arisen in the past, about certain subsidies which have been given to favored steamship lines, the paying of subsidies by the general Government to shipping has been generally unpopular among people who reside in sections of the country not in touch with shipping, and yet these same people have been assisted by subsidies ever since the beginning of this Government. What was the enormous land grants to railroads but a subsidy, and it was these land grants which opened up the entire Western and Middle West of the United States? What are the Government expenses on rivers but subsidies? Has not the Government spent millions of dollars in destroying the pests and improving conditions on farms, are they not subsidies? Recently we authorized $300,000,000 for good roads, and nearly one-half of this is already spent or authorized, is not this also a subsidy? And so you could find by investigation that the Government expends vast sums of money, all of which can be classed as aids to special interests.

"The experiences of the past few years," Congressman Edmonds pointed out, "has shown conclusively that our Government as it is situated, is not flexible enough to enter into the business enterprises in which foreign competition is a principal factor. Decisions must be met on a moment's notice and can only be made by a management that is capable and has authority to do so. A Government department or even an executive officer cannot have such flexibility conferred upon them as will be possible in a private corporation. International competition does not lend itself easily to rules and regulations. One thing is particularly fortunate at the present time that we have now several years' experience in the world's shipping business and established certain connections which will assist in the proper conduct of the business. All of this helps and will assist us in retaining a considerable percentage of our tonnage. In the meantime it must be presumed that the continued loss occasioned by the operation of these vessels under Government ownership, together with the depreciation, will continue until the merchant marine of our country dies either from lack of appropriation to continue this loss, or the old age of the vessels will render them obsolete, and we will gradually drift back to allowing our competitors to do our carrying business. Control of the terminal carriage business in our export trade means control of the prices of the commodities exported. Certainly those opposed to the subsidy bill cannot but view with alarm the making of the prices for our own commodities by our foreign competitors in the same."



(Photograph by Kadel & Herbert, N. Y.)

View Showing Rudder of Cunard Liner Berengaria While the Vessel Was in Dry Dock at Southampton

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FORM 7197

UNITED STATES SHIPPING BOARD EMERGENCY FLEET CORPORATION

FUEL DEPARTMENT

SUMMARY OF GENERAL INSTRUCTIONS TO CHIEF ENGINEERS FOR HANDLING BUNKER AND CARGO FUEL OIL AND COAL

I. ORDERING.

A. As much advance notice as possible shall be given by the Master (preferably 48 hours) to the port representative of the Emergency Fleet Corporation or Agent for the vessel.

B. If any trouble exists with burning equipment, tanks, coils, also if any tanks contain any fuel oil not usable, same should be reported at time request for oil is made.

C. Avoid Sundays, holidays, or night deliveries as much as possible.

D. If tugs are necessary to furnish steam, same should be specified when ordering fuel oil.

E. State exact position of vessel and time vessel will be ready to give barge clear berth.

F. State size and type of filling connections.

II. RECEIVING.

A. Bunker tanks should be reasonably free from water, sediment, and other foreign substance and otherwise be in proper condition to receive oil.

B. It shall be the duty of the Chief Engineer, or one of his assistants who is thoroughly familiar with the vessel's fuel-oil system, to be on board at all times when the vessel is receiving fuel and provide the services of sufficient personnel to satisfactorily handle lines and make hose connections.

C. It is imperative to have an understanding with the captain of the barge or deck foreman about signals for "starting," "slowing down," and "stopping."

III. BARGE DELIVERIES.

A. The exact time should be taken when the oil barge comes alongside, when pumping starts, and when pumping has been completed.

B. Ascertain if barge is calibrated and if calibration tables are on board.

C. Before pumping starts, the Chief Engineer or assistant with the barge captain, will gauge and take temperature of the oil. After delivery is complete the engineer and barge captain will again gauge and take temperature of barge tanks and agree on the amount of oil delivered by careful checking of measurements against the calibration tables.

D. If no calibration tables are on barge, the Chief Engineer will note on the delivery tickets the measurements of the barge tanks and the temperature of both opening and closing gauges. Chief Engineer will then sign receipt for one lot of oil delivered and show temperature. He must also note on receipt any delay incident to the delivery and show quantity as shown by measurements of vessel's tanks.

E. In cases where bunkers are taken at the oil docks, the Chief Engineer shall go ashore or send a competent assistant to witness the opening and closing gauges of the shore tanks, take temperature of the oil, and compare gaugings with calibration tables of the shore tanks to determine quantity received.

IV. SAMPLE.

A. When the Emergency Fleet's inspector is not present the Chief Engineer shall see that a fair sample of the oil delivered has been taken. He shall insist that supplier furnish him with at least one pint of the sample, same to be sealed and initialed by the supplier's representative and the Chief Engineer, and be retained by the Chief Engineer at least thirty days. If any trouble is found with the oil, the Chief Engineer is to turn the sample, with seal unbroken, over to the Emergency Fleet Corporation's representative or agent of the vessel at the first port of call for analysis, and make a written report as to the quality and trouble with the oil.

B. Bunker tanks are to be sounded before delivery and after oil has had time to cool. This will give a further check on the amount of oil received. If any great difference in figures, the fact should be promptly reported to the port representatives.

C. For making temperature adjustment in ascertaining net quantities of fuel oil, use the divisional method. Multiply difference in temperature above 60° F. by .0004, add 1 and use result as divisor in dividing the gross barrels; the product will be the net barrels. For example, if 8,000 barrels of oil were received at a temperature of 100° F. the temperature correction would be worked out as follows:

100 − 60 = 40 degrees difference in temperature.
.0004 × 40 = 0.016 plus 1 = 1.016; 8000 ÷ 1.016 = 7874.01 barrels, or actual net quantity of oil received at 60° F.

V. COAL BURNERS.

A. When taking coal bunkers alongside coal piers in the absence of the Emergency Fleet Corporation's inspector, the Chief Engineer shall keep a record of the number of pier cars dumped through the chutes into his vessels and should in every case procure from the pier superintendent a copy of dumping ticket, which ticket should show number of cars dumped and weight of each car.

B. When taking coal bunkers from lighters, scows, or barges, the Chief Engineer shall have some one aboard vessel check the quantity of coal received.

C. The Chief Engineer should use the following cubic capacity, which will be used in figuring the amount of coal in bunkers: 42 to 45 cubic feet per ton of 2,240 pounds. Fine coal will usually run 42 cubic feet to the ton, and large lumps will usually equal 45 cubic feet to the ton. It will be necessary for the Chief Engineer to judge the sizes of the coal in order to get a more accurate check of bunkers received.

D. The Chief Engineer shall give careful study of the capacity of his coal bunkers at different levels and to the manner in which the coal is trimmed in order to give him a further check on the quantity he receives.

E. The Chief Engineer should know the quality of coal that has been ordered and be at least partly familiar with its characteristics, and should himself inspect or have a member of his staff inspect the coal as it comes aboard for any unusual amount of bony coal, shale, dirt, or any other foreign substance. If it is found that the coal is not up to the standard quality of the coal he is supposed to receive, he should at once protest to his port representative. If he is compelled to take the coal, he should note poor quality on the delivery ticket and on his log.

GENERAL.

A. Chief Engineers should turn over all fuel oil in vessel's tanks as often as possible—at least every 30 days, especially in double bottom and peak tanks. Fuel oil allowed to age in vessel's tanks generally becomes contaminated.

B. Special attention should be given at all times to the danger of allowing any oil to enter the waters of the harbor.

C. Every precaution should be taken in using water ballast to avoid mixing water with fuel oil.

D. Special effort should also be made to minimize amount of smoke escaping from anchored or docked vessels.

LOADING AND BUNKERING OF OIL.

The Master will be held strictly responsible for the enforcement of the National Fire Protection Association rules for receiving bunker oil, as quoted below:

Before commencing to load oil, all signal bells, gongs, etc., shall be tested to insure working condition.

Hose used for filling or discharging shall be of the flexible metallic type; couplings shall be equipped with sleeves or some other approved device for the purpose of taking up shock and preventing rupture of connections through tension, in the event of a vessel moving during filling operation.

While oil is being received or discharged, no open lights, smoking or electrical apparatus liable to spark shall be permitted within 50 feet of an oil hose, tank, compartment containing a tank, or vents. Storage tanks shall be watched for leaks.

Hatches on tankers shall be kept closed during loading or discharging. Tugs or other steam vessels shall not be allowed alongside when hatches are open.

If practicable galley fires in tankers shall be extinguished; otherwise openings to the galley shall remain tightly closed during loading or discharging.

On tankers there shall be no fire in the donkey boiler, and all drafts and openings shall remain closed and the fire room hatches covered.

Loading or discharging should, as far as possible, be carried on in the daytime. When carried on at night no lights should be permitted on the deck. Lights shall be in clusters and suspended in the rigging at a safe distance from deck and the wires shall not drag across the deck.

The Chief Engineers shall give close attention to any special instructions issued by the Emergency Fleet Corporation that may affect bunkering at certain ports.

Approved by:

Captain C. A. McALLISTER, Chairman
Captain R. D. GATEWOOD, (CC) U. S. N.
Major GEORGE M. TALBOT
Mr. E. H. PEABODY
Mr. MAURICE HEALEY
Mr. F. B. WEBSTER
Colonel GEORGE BARTLETT
Mr. D. M. MYERS

Fuel Conservation Committee

JOSEPH E. SHEEDY,
Vice President, Emergency Fleet Corporation

Instructions Issued to Every Shipping Board Vessel. To Be Posted in a Conspicuous Place

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Comparison of Steamships and Converted Motorships

By Lawrence B. Chapman*

The following comparison has been made in view of the keen present day interest in the possibilities of converting idle Shipping Board vessels to motorships. There are a large number of these idle ships that will probably be thrown on the market in the near future at relatively low figures. Some of these ships will be converted to motorships while others will be refitted and repaired to operate with the existing steam machinery.

IN order that the ships that are converted to motorships should be able to compete with the steamers, the ships for conversion should sell at a somewhat lower price per ton. Shipowners hesitate to adopt Diesel machinery because of the larger capital charges of the motorship compared to those of the steamship; and, unless they can see a possibility for a gain over the steamship, many will hesitate to buy these ships and convert them to motorships.

The following comparison has been worked up to throw some light on the comparative performances of the motorship and steamship with different initial costs and on different trade routes. A hypothetical ship of 10,000 tons deadweight has been used and various prices per deadweight ton have been used as outlined below. The comparison is based on annual operating expenses and profits on given trade routes, which is the only way any true comparison can be made.

Certain general assumptions have been made for the assumed ship and the calculations then carried through in as consistent and unbiased a manner as possible. While almost countless minor modifications and variations can be made in the general assumptions, data and conditions of operation, the comparisons tabulated in Tables II and III indicate in a general way the results to be expected on voyages of 5,000 and 10,000 miles. If actual operating data or costs are available that differ from those used, changes can readily be made in the table for a particular case. The main feature in any comparison of this sort is to account for all operating expenses and allow the proper cargo deadweights and fuel consumptions.

In working up the comparison, the gross deadweights have been modified for each ship according to the weight of the machinery installed. This of course reacts to the disadvantage of the motorship, especially on short voyages. On the other hand, the net cargo deadweight used in calculating freight rates allows for the weight of the fuel and feed water required for the voyage in question. This is decidedly to the advantage of the motorship and shows up especially in the comparison of tons carried per year on the 10,000 mile voyage (line 15 in Table III). A twin screw installation has been used for the motorship as this allows higher revolutions per minute and consequently a lighter machinery installation, for a given propeller efficiency.

Main Particulars of Ship

The dimensions and other characteristics of the standard ship chosen for the comparison are given below. It does not represent any existing ship but merely one assumed for the comparison.

Length between perpendiculars	420 feet
Beam	58 feet
Depth	35 feet
Draft	26 feet 6 inches
Displacement	14,380 tons
Block coefficient	0.78
Sea speed	10½ knots
Net tonnage (about)	4,700
Weight of hull and equipment	4,000 tons

*Professor of Naval Architecture, Lehigh University, Bethlehem, Pa.

Four types of machinery installations have been used as follows:

(1) Four cycle Diesel propelling machinery with steam engine room and deck auxiliaries (twin screw).

(2) Four cycle Diesel propelling machinery with electric engine room and deck auxiliaries (twin screw).

(3) Geared turbines, watertube boilers with oil fuel (single screw).

(4) Triple expansion engines, Scotch boilers with oil fuel (single screw).

The geared turbine installation has been purposely assumed as good service practice and the reciprocating engine somewhat worse than might be expected, in order to cover a wider range in the comparison.

Assumptions

The following general assumptions have been made:

(1) Cost of steamship for conversion to motorship = $10 per deadweight ton "as is."

(2) Cost of steamship to operate with existing steam machinery = $25, $30, $40 and $50 per deadweight ton.

(3) Cost of converting from steam to Diesel machinery:

(a) Keeping all steam engine room and deck auxiliaries = $350,000.

(b) Changing all engine room and deck auxiliaries to electrically operated = $500,000.

The conversion costs are approximately the accepted figures today and agree very closely with figures given by Mr. J. L. Ackerson in his paper before the Society of Naval Architects and Marine Engineers in November, 1922, which appears elsewhere in this issue. The costs per ton for the steamship are for the ship ready for service which will include a charge of between $5 and $10 for overhauling and repairing.

(4) Days lost per year for repairs, overhauling, and docking = 30.

(5) Fuel carried is 20 percent greater than the calculated required amount for the voyage. The fuel cost that has been allowed is 5 percent greater than the calculated amount.

(6) Time in port increased 10 percent over the calculated time for handling cargo to allow for tides, holidays and delays.

(7) Time at sea increased 5 percent over calculated time to allow for bad weather.

(8) Ships assumed fully loaded to draft marks.

(9) Life of converted motorship taken as 20 years (5 percent depreciation) and life of steamship after a general overhauling taken as 14⅓ years (7 percent depreciation).

(10) Insurance on steamship has been taken slightly higher than converted motorship as shown by line 17 in Tables II and III.

(11) Repairs, maintenance, painting and overhauling of the ship and machinery have been assumed 5 percent of original cost per year for the motorship and 6 percent for the steamship.

(12) It is assumed that a rate of 30 tons per hour can be maintained in loading and unloading cargo. This is at the rate of one draft per minute with a draft of 1,120 pounds,

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which can easily be maintained. Allowing 5 hatches in operation for 10 hours per day, 1,500 tons per day are handled. (See article by the writer in the February issue of Marine Engineering and Shipping Age.)

(13) The net tonnage has been taken as 4,700 tons for all the ships; the double bottom was considered available for fuel oil and the machinery space in each case is above 13 percent of the gross tonnage.

(14) The make-up feed water carried has been taken as 3 percent of the total steam consumption of the voyage, assuming that an evaporator is used to take care of any excess over 3 percent.

(15) Port fuel for the steamship and motorship with steam auxiliaries is 7 tons per day; and for the motorship with electric auxiliaries, 1 ton per day.

(16) Fuel oil for the steamship has been assumed at $1.50 a barrel and 8 pounds per gallon ($10 per ton); Diesel engine oil has been assumed at 4½ cents per gallon ($1.88 per barrel) and 7.35 pounds per gallon ($13.65 per ton).

(17) Lubricating oil at 75 cents per gallon has been allowed for as follows, which is the average practice in service:

Geared turbine 1 gallon per 10,000 shaft horsepower hours.
Reciprocating engine 1 gallon per 4,000 indicated horsepower hours.
Diesel engine 1 gallon per 3,000 shaft horsepower hours.

(18) Fresh water has been calculated at 50 cents per ton.

Table I shows the calculated data, assumed steam pressures, vacua, revolutions of propeller, boiler efficiency and machinery weights. The effective horsepower has been carefully calculated from Robertson's results and the propeller efficiency has been taken from Taylor's ρ δ charts. The effective horsepower of the motorship was increased 40 horsepower to allow for the resistance of the struts. A hull efficiency of 1.05 was adopted for the single screw steamship and 1.00 for the twin screw motorship.

The calculated shaft horsepower has been increased by 20 percent to allow for the increase of power in service. The efficiency ratio and boiler efficiency have been assumed to correspond to good service conditions and are naturally lower than trial and test results. The calorific value of the fuel oil for the steamships has been taken as 18,000 British thermal units per pound, which is a conservative value. The data used and results of the calculations for steam and fuel consumption are also given in Table I. Because of the large amount of fuel and make-up feed water carried on the 10,000 mile voyage the steamships will be unable to carry all of this in the double bottom and consequently will lose some cargo space. In fact, the ship would probably re-fuel during the voyage instead of carrying the entire fuel and water weight. The results, however, as worked up with all fuel and water are very valuable for comparative purposes.

The machinery weights include all engineering weights in engine and boiler rooms, shafting and propellers, and generating sets. The water in the boilers, engines and piping is included but make-up feed water is *not* included as a machinery weight.

The results of the comparison are tabulated in Table II for a voyage of 5,000 miles and in Table III for a voyage of 10,000 miles. The calculations for the geared turbine steamship for 5,000 mile voyage are given below to illustrate the procedure in obtaining the results tabulated in Tables I, II and III.

Table I

		Motor ship	Steamship No. 1	Steamship No. 2
1.	Type of machinery	4 cycle Diesel	Geared turbine	Triple expansion
2.	Type of boilers	....	Watertube	Scotch
3.	Model E.H.P. at 10½ knots	1,260	1,220	1,220
4.	Number of screws	2	1	1
5.	Propeller efficiency	0.605	0.550	0.585
6.	Propulsive coefficient	0.605	0.570	0.615
7.	R.P.M.	115	90	75
8.	S.H.P. + 20 percent margin	2,500	2,570	2,400
9.	I.H.P. + 20 percent margin (mechanical efficiency = 0.90)	....	....	2,670
10.	Boiler pressure (gage)	....	250	200
11.	Superheat (degrees F.)	....	60°	0
12.	Vacuum (inches Hg.)	....	28	26
13.	$H_1 - q_2$ (feed = 200 degrees F.)	....	1,075	1,031
14.	$H_1 - H_2$	....	369	307
15.	Efficiency ratio in service	....	0.62	0.575
16.	Main engine steam consumption (pounds per S.H.P. per hour)	....	11.12	....
16a.	Main engine steam consumption (pounds per I.H.P. per hour)	....	....	14.40
17.	Auxiliary steam consumption	....	25 percent	15 percent
18.	Total steam (pounds per S.H.P. per hour)	....	13.9	....
18a.	Total steam (pounds per I.H.P. per hour)	....	....	16.65
19.	Total steam per hour (pounds)	....	35,800	44,500
20.	Boiler efficiency in service	....	70 percent	70 percent
21.	Rate of combustion (pound per square foot heating surface)	....	0.50	0.50
22.	Calculated fuel (per S.H.P. per hour in service)	0.42	1.19	1.52
22a.	Calculated fuel (per I.H.P. per hour in service)	....	....	1.37
23.	Calculated fuel per hour in service (pounds)	1,050	3,060	3,650
24.	Weight of machinery (pound per S.H.P.)	600	330	....
24a.	Weight of machinery (pound per I.H.P.)	....	....	490
25.	Total weight of machinery (tons)	670	380	585
26.	Make up feed water carried (3 percent) 5,000 miles (tons)	....	240	300
27.	Make-up feed water carried (3 percent) 10,000 miles (tons)	....	480	600
28.	Stores and provisions (5,000 miles) (tons)	50	50	50
29.	Stores and provisions (10,000 miles) (tons)	100	100	100
30.	Calculated fuel weight for 5,000 miles + 20 percent reserve (tons)	280	820	975
31.	Calculated fuel weight for 10,000 miles + 20 percent reserve (tons)	560	1,640	1,950

Calculations for Steamship with Geared Turbine

$$\text{Steam consumption} = \frac{2{,}545}{H_1 - H_2 \times \text{efficiency ratio}} = \frac{2{,}545}{369 \times 0.62} =$$

11.12 pounds per S. H. P. hour.

Total steam per hour $= 11.12 \times 1.25 \times 2{,}570 = 35{,}800$ pounds.

$$\text{Fuel per hour} = \frac{(H_1 - q_2) \times \text{steam per hour}}{\text{B.t.u. per pound oil} \times \text{boiler efficiency}} =$$

$$\frac{1{,}075 \times 35{,}800}{18{,}000 \times 0.70} = 3{,}060 \text{ pounds per hour.}$$

$$\left(\frac{3{,}060}{2{,}570} = 1.19 \text{ pounds per S.H.P. per hour.}\right)$$

$$\text{Weight of fuel carried per trip} = \frac{20.8 \times 24 \times 3{,}060}{2{,}240} \times 1.20 =$$

820 tons.

(An allowance of 20 percent reserve has been allowed for weight of fuel carried as indicated above.)

Make-up feed water for geared turbine ship $= \frac{20.8 \times 24 \times 35{,}800 \times 0.03}{2{,}240} = 240$ tons per trip.

Make-up feed water reciprocating engine ship $= \frac{20.8 \times 24 \times 44{,}500 \times 0.03}{2{,}240} = 300$ tons per trip.

3. Gross deadweight = displacement — (hull + machinery weights) $= 14{,}380 - (4{,}000 + 380) = 10{,}000$ tons.

4. Cargo deadweight = gross deadweight — (fuel + water + stores) $= 10{,}000 - (820 + 240 + 50) = 8{,}890$ tons.

9. Days on run $= \frac{5{,}000}{10.5 \times 24} \times 1.05 = 20.8$ days.

10. Days in port $= \frac{8{,}890 \times 2}{1{,}500} \times 1.10 = 13.0$ days.

12. Single trips per year $= \frac{365 - 30}{20.8 + 13} = 9.9$ trips.

15. Tons carried per year $= 8{,}890 \times 9.9 = 88{,}000$ tons.

21. Fuel used at sea per trip $= \frac{3{,}060 \times 20.8 \times 24}{2{,}240} \times 1.05 = 717$ tons.

Fuel used in port per trip $7 \times 13 = 91$ tons.

Total fuel used per single trip $717 + 91 = 808$ tons.

Cost of fuel per year $808 \times 9.9 \times \$10 = \$80{,}000$.

22. Lubricating oil at 1 gallon per 10,000 shaft horsepower hours.

$$= \frac{2{,}570 \times 20.8 \times 24 \times 9.9}{10{,}000} = 1{,}270 \text{ gallons per year.}$$

Cost of lubricating oil at 75 cents per gallon = $950 per year.

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TABLE II—ANNUAL OPERATING EXPENSES (BASED ON A CARGO EQUAL TO THE NET DEADWEIGHT CAPACITY) 5,000 MILES

		1	2	3	4	5	6	7	8	9
1	Type of propelling machinery	Diesel Steam	Diesel Electric Auxiliaries	Geared Turbine	Triple Expansion	Geared Turbine	Triple Expansion	Geared Turbine	Triple Expansion	Geared Turbine
2	Type of boilers	Auxiliaries		W. T.	Scotch	W. T.	Scotch	W. T.	Scotch	W. T.
3	Gross deadweight	9,710	9,710	10,000	9,795	10,000	9,795	10,000	9,795	10,000
4	Cargo deadweight (Item 3—fuel, stores and water)	9,380	9,380	8,890	8,470	8,890	8,470	8,890	8,470	8,890
5	Calculated service fuel per S.H.P per hour (from table 1)	0.42	0.42	1.19	1.52	1.19	1.52	1.19	1.52	1.19
6	Days overhauling and lost per year	30	30	30	30	30	30	30	30	30
7	Rate of stevedoring (tons per hatch per hour)	30	30	30	30	30	30	30	30	30
8	Rate of stevedoring (tons per 10-hour day) 5 hatches	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
9	Days on run (calculated time + 5%)	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8
10	Days in port (calculated time for handling cargo + 10%)	13.75	13.75	13.0	12.4	13.0	12.4	13.0	12.4	13.0
11	Days per single trip	34.55	34.55	33.8	33.2	33.8	33.2	33.8	33.2	33.8
12	Single trips per year	9.7	9.7	9.9	10.1	9.9	10.1	9.9	10.1	9.9
13	Initial cost of ship (including cost of conversion) ready for Service	$450,000	$600,000	$250,000	$244,000	$300,000	$294,000	$400,000	$392,000	$500,000
14	Present values per gross deadweight ton (dollars)	$46.30	$61.80	$25.00	$25.00	$30.00	$30.00	$40.00	$40.00	$50.00
15	Tons carried per year at full deadweight capacity	91,000	91,000	88,000	85,500	88,000	85,500	88,000	85,500	88,000
	Annual Expenses									
16	Depreciation (5% on motorship; 7% on steamship)	$22,500	$30,000	$17,500	$17,100	$21,000	$20,600	$28,000	$27,400	$35,000
17	Insurance on hull and machinery (5% and 6%)	22,500	30,000	15,000	14,650	18,000	17,600	24,000	23,500	30,000
18	Repairs, maintenance and overhauling (5% and 6%)	22,500	30,000	15,000	14,650	18,000	17,600	24,000	23,500	30,000
19	Profit on investment (10%)	45,000	60,000	25,000	24,400	30,000	29,400	40,000	39,200	50,000
20	Total capital charges	$112,500	$150,000	$72,500	$70,800	$87,000	$85,200	$116,000	$113,600	$145,000
21	Fuel used at sea and in port	$46,400	$34,400	$80,000	$95,000	$80,000	$95,000	$80,000	$95,000	$80,000
22	Lubricating oil and make-up feed water	3,040	3,040	2,140	4,035	2,140	4,035	2,140	4,035	2,140
23	Wages of crew	37,500	37,500	37,500	37,500	37,500	37,500	37,500	37,500	37,500
24	Subsistence of crew (70 cents per man per day)	8,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500
25	Tonnage dues and port charges	32,250	32,250	32,300	32,350	32,300	32,350	32,300	32,350	32,300
26	Brokerage and management at 50 cents per ton carried	45,500	45,500	44,000	44,750	44,000	44,750	44,000	44,750	44,000
27	Stevedoring of cargo at 70 cents per ton	127,500	127,500	123,000	119,500	123,000	119,500	123,000	119,500	123,000
28	Annual operating expenses (sum of 20 to 27)	$413,000	$439,000	$400,000	$412,000	$415,000	$427,000	$444,000	$455,000	$473,000
29	Rate per ton of cargo to give 10% return on investment	$4.54	$4.82	$4.54	$4.82	$4.71	$5.00	$5.05	$5.32	$5.38

TABLE III—ANNUAL OPERATING EXPENSES (BASED ON A CARGO EQUAL TO THE NET DEADWEIGHT CAPACITY) 10,000 MILES

		10	11	12	13	14	15
1	Type of propelling machinery	Diesel Steam	Diesel Electric	Geared	Geared	Geared	Triple Expansion
2	Type of boilers	Auxiliaries	Auxiliaries	W. T.	W. T.	W. T.	Scotch
3	Gross deadweight	9,710	9,710	10,000	10,000	10,000	9,795
4	Cargo deadweight (Item 3—fuel, stores and water.)	9,050	9,050	7,780	7,780	7,780	7,145
5	Fuel in service per S.H.P. per hour (from table 1)	0.42	0.42	1.19	1.19	1.19	1.52
6	Days overhauling and lost per year	30	30	30	30	30	30
7	Rate of stevedoring (tons per hatch per hour)	30	30	30	30	30	30
8	Rate of stevedoring (tons per 10-hour day; 5 hatches)	1,500	1,500	1,500	1,500	1,500	1,500
9	Days on run (calculated time + 5%)	41.6	41.6	41.6	41.6	41.6	41.5
10	Days in port (calculated time + 10%)	13.25	13.25	11.4	11.4	11.4	10.45
11	Days per single trip	54.85	54.85	53.0	53.0	53.0	52.05
12	Single trips per year	6.10	6.10	6.32	6.32	6.32	6.43
13	Initial cost of ship, ready for service (including cost of conversion)	$450,000	$600,000	$250,000	$300,000	$400,000	$294,000
14	Present value per gross deadweight ton	$46.30	$61.80	$25.00	$30.00	$40.00	$30.00
15	Tons carried per year	55,200	55,200	49,200	49,200	49,200	46,000
	Annual Expenses						
16	Depreciation (5% on motorship; 7% on steamship)	$22,500	$30,000	$17,500	$21,000	$28,000	$20,600
17	Insurance (5% and 6%)	22,500	30,000	15,000	18,000	24,000	17,600
18	Repairs, maintenance and overhauling (5% and 6%)	22,500	30,000	15,000	18,000	24,000	17,600
19	Profit on investment (10%)	45,000	60,000	25,000	30,000	40,000	29,400
20	Total capital charges	$112,500	$150,000	$72,500	$87,000	$116,000	$85,200
21	Fuel used at sea and in port	$52,700	$41,800	$95,600	$95,600	$95,600	$115,000
22	Lubricating oil and make-up feed water	6,080	6,080	4,280	4,280	4,280	8,070
23	Wages of crew	37,500	37,500	37,500	37,500	37,500	37,500
24	Subsistence of crew	8,500	8,500	8,500	8,500	8,500	8,500
25	Tonnage, dues and port charges	20,000	20,000	19,700	19,700	19,700	19,300
26	Brokerage and management at 50 cents per ton	27,600	27,600	24,600	24,600	24,600	23,000
27	Stevedoring of cargo at 70 cents per ton	77,200	77,200	69,000	69,000	69,000	64,400
28	Annual operating expenses (sum of 20 to 27)	$342,000	$369,000	$332,000	$346,000	$375,000	$361,000
29	Rate per ton cargo to give 10% return on investment	$6.19	$6.70	$6.72	$7.04	$7.62	$7.85

Cost of make-up feed water at 50 cents per ton (geared turbine ship) $= 240 \times 9.9 \times \$0.50 = \$1{,}190$ per year.

22a. Lubricating oil for reciprocating engine ship.
1 gallon per 4,000 I.H.P. hours.

$$\frac{2{,}670 \times 20.8 \times 24 \times 10.1}{4{,}000} \times \$0.75 = \$2{,}520 \text{ per year.}$$

Cost of make-up feed water at 50 cents per ton $=$
$300 \times 10.1 \times 0.50 = \$1{,}515.$

25. Port charges:

Pilotage (inward and outward)	$300
Towage (inward and outward)	200
Miscellaneous fees	100
Cooperage and dunnage	300
Clerks, watchmen, etc.	200
	$1,100
Dockage at 2 cents per ton per day $= 4700 \times 13 \times 9.9 \times \$0.02$	$12,100
Tonnage dues (6 cents and 34 cents) $= 4700 \times \$0.20 \times 99$	9,300
Miscellaneous fees listed above $= 1100 \times 9.9$	10,900
Total port charges per year	$32,300

27. Stevedoring of cargo $= 88{,}000 \times 2 \times 0.70 = \$123{,}000.$

CALCULATIONS FOR MOTORSHIP (Electric Auxiliaries and Winches)

10. Days in port $\dfrac{9{,}380 \times 2}{1{,}500} \times 1.10 = 13.75$ days.

21. Fuel used at sea per trip $= \dfrac{1{,}050 \times 20.8 \times 24}{2{,}240} \times 1.05 = 246$ tons.
Fuel used in port $1 \times 13.75 = 13.75$ tons.
Total fuel per single trip $= 260$ tons.
Cost of fuel per year $= 260 \times 9.7 \times \$13.65 = \$34{,}400.$

22. Lubricating oil at 1 gallon per 3,000 shaft horsepower hours

$$= \frac{2{,}500 \times 20.8 \times 24 \times 9.7}{3{,}000} = 4{,}040 \text{ gallons per year.}$$

Cost of lubricating oil at 75 cents per gallon $= \$3{,}040$ per year.

21a. Fuel used by motorship with steam auxiliaries and winches and donkey boiler.
Additional fuel used at sea by steam auxiliaries (allowing 2 tons per day increase over electric auxiliaries) $=$
$2 \times 20.8 \times \$10 \times 9.7 = \$4{,}000$ a year.
Increase in port fuel with steam winches
$13.75 \times 6 \times \$10 \times 9.7 = \$8.000.$
Total fuel cost per year $= \$34{,}400 + \$12{,}000 = \$46{,}400.$

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24. The wages of the crew are given below. The monthly wages for all the ships are kept the same. The motorships will have the same crew as the steamships with the exception of the firemen. There will, however, be electricians or additional motormen carried on a twin screw motorship and the wages of these additional men will practically balance the firemen of the steamships.

Crew's Monthly Wages (U. S. S. B. Scale, effective April, 1922).

Master	$300	Second Assistant	$145
First Officer	165	Third Assistant	130
Second Officer	145	Deck Engineer	70
Third Officer	130	Oilers (3)	195
Carpenter	65	3 Firemen or 2 Electricians	172.50
Able Seaman (7) at $55	385	Wipers (3) at $50	150
Ordinary Seaman (3) at $40	120	(14)	$1,267.50
Radio Operators (2) at $90	180	Steward	$105
		Cook	90
Deck Department (17)	$1,490	Second Cook	70
Chief Engineer	$240	Mess boys (3)	105
First Assistant	165		$370
		Total per pear	=$37,500

Conclusions

In order to make a definite comparison of the several ships, an item of profit (line 19) equal to 10 percent of the initial cost has been added as one of the capital charges. It is true that profit is not generally considered as one of the capital charges; yet it gives a convenient method for the analysis and allows the comparison to be based on freight rates per ton carried (line 29).

The results of the comparison for the 5,000 mile voyage, shown in the last line of Table II, indicate the following:

(1) The motorship with the all steam auxiliaries shows a gain of about 6 percent over the motorships with electric engine room and deck auxiliaries. Or for a freight rate of $4.54 per ton the motorship with steam auxiliaries would pay a profit of 10 percent against 5.7 percent for the motorships with electric auxiliaries.

(2) A motorship with all steam auxiliaries, selling at $10 a ton before converting, will give the same return on the investment as a geared turbine steamship selling at a price such that it can be put in service at an overall cost of $25 per ton. The ship fitted with triple expansion engines and Scotch boilers must be worth less than $25 a ton to operate on an equal basis. (Line 29, Table II, Column 4.)

(2a) A motorship (with all electric auxiliaries) selling at $10 a ton will operate on the same basis as a geared turbine and watertube boiler ship worth about $33 a ton. Allowing $10 per ton for reconditioning the steamship, which is to be run with the original steam machinery, the ship should sell for $23 per ton to pay the same profit as the motorship. The reciprocating engine ship will be on an equal basis at a service value of $25 a ton or a selling price of about $15 a ton.

(3) If the geared turbine ship is to sell "as is" for $30 a deadweight ton and allowing $10 a ton for refitting and repairs (total value $40 a ton), the freight rate will be $5.05 per ton carried (Column 7). For the motorship with electric auxiliaries to give a 10 percent return with this same freight rate the original cost before conversion would be $18.50 per deadweight ton.

Present annual expenses (line 29, Table II, Column 7)	=$439,000
Increase capital charges at $18.50 per ton (185,000 — 100,000) × 25 percent	= 21,000
New operating expenses	=$460,000
Rate when carrying 91,000 tons per year	$5.05

(4) For the same conditions mentioned in (3) above the reciprocating engine ship should sell for a price such that it can be put in service at a cost of about $30 per ton. (Column 6, Table II.)

(5) A comparison of lines 29 and 14 in Table II shows in general that for equal profits at the same freight rate, the value per ton deadweight for the geared turbine steamship should be about half that of the motorship with all steam auxiliaries. The reciprocating engine ship should have a value of about one-third that of the motorship. If the comparison is made with the motorship with electric auxiliaries, the above ratios are about 1 : 2 and 1 : 2½.

As already pointed out this comparison is not intended to indicate that all geared turbine ships are always more economical than reciprocating engine ships. Table I shows clearly that the geared turbine installation is better not only because of the higher initial heat contents, lower vacuum and better efficiency ratio, but also because of the lighter weight of the watertube boilers. The two types of steamships may be considered, if desired, as representing a steamship with good economy and a steamship with poor economy, irrespective of the type of machinery and boilers installed.

While the foregoing analysis indicates that the converted motorship with all steam auxiliaries is superior to the motorship with all electric auxiliaries, it is very doubtful if this difference would be realized under actual working conditions covering a period of years. The repairs and depreciation on the steam auxiliaries would no doubt be higher than for the electric auxiliaries. Further, it may be that the fuel consumption allowed for the steam auxiliaries at sea is too low. By standardizing the sizes and power of the electric auxiliaries and Diesel generating sets the first cost may be appreciably lower than that used in the calculations. The all-electric auxiliary installation is by far the simplest and most satisfactory from an engineering standpoint and certainly deserves a very careful analysis based on more complete data than the writer had access to.

(6) On the 10,000 mile voyage (Table III) the results are in general similar to those for the 5,000 mile voyage except that the advantage of the motorship is even more marked. For instance, columns 11 and 12 (Table III) show practically identical freight rates (line 29) for a 10 percent profit, yet line 14 shows the total cost of the motorship per gross deadweight ton practically 2½ times that of the steamship. On the 5,000 mile voyage the ratio of costs was about 2 to 1 instead of 2½ to 1 shown here.

If the steamship (Column 14, Table III) sells for $30 per ton + $10 for the reconditioning (total value $40 per gross deadweight ton), the ship for conversion to motorship with all electric auxiliaries could sell at $31.20 and still pay the same profit as the steamship for a given freight rate. In other words, for a 10,000 mile voyage a ship could be purchased at the same price as the steamer to run "as is" and be converted to a motorship with all electric auxiliaries and make the same profit as the steamship!

Annual receipts from cargo at $7.62 ton = 7.62 × 55,200	=$422,000
Annual operating expenses, column 11, Table III	= 369,000
Increase possible in capital charges	= $53,000
Total capital charges ($53,000 + 150,000)	=$203,000
New value of ship	812,000
Conversion charge	500,000
Original value of ship ($31.20 per ton)	$312,000

The results given in the tables are for a ship of 10,000 tons gross deadweight and a sea speed of 10½ knots but the results will have practically the same relative values for ships of 8,000 to 12,000 tons and speeds of 10 to 11 knots. Speeds much lower than 10 knots are too low for the best results in service and most of the cargo ships built during the war are hardly suitable for speeds greater than 11 knots.

Mr. John Anderson in his paper before the Institution of Naval Architects in 1918 has shown that ships of less than 8,000 tons are not suitable for long voyages, and the writer has shown in his article in the January issue of Marine Engineering and Shipping Age that the Diesel engine does not have any advantage over steam for short voyages. Hence it does not appear feasible to convert the smaller 5,000-ton ships built by the Submarine Boat Corporation into

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motorships. However, only a comparative study of this size ship on a given trade route with both steam and Diesel machinery can decide the point definitely. A comparison of the data in Tables I, II and III shows that the motorship is more economical on the longer voyages where saving in the weight of fuel and water is a large item.

CUBIC SHIPS AND SHIPS NOT LOADED TO FULL CAPACITY

In studying the results presented in Tables II and III it should be distinctly borne in mind that they are worked up for ships with cargo weights equal to their full net deadweight capacity. A considerable portion of the advantage gained by the motorship is due to the increased deadweight carrying capacity brought about by the reduced weights of fuel and feed water. For cubic ships that carry cargoes occupying more than 50 cubic feet per ton and ships that are not loaded to the draft marks, the motorship cannot claim the advantages of increased deadweight capacity. Further, the space occupied by the machinery in the motorship will be no smaller than that occupied by geared turbines and watertube boilers; hence there is no gain for the motorship in cubic capacity on voyages under about 6,000 miles. On a voyage of 10,000 miles, however, there is a gain for the motorship in cubic space as the steamship cannot stow in the double bottom all the water and fuel oil for so long a voyage.

On the 10,000 mile voyage, if the ships are not loaded to the draft marks, the cargo deadweight for comparative purposes will be the same. Let us assume the cargo carried per voyage is 6,000 tons for each ship. The following table gives the data and results for such a case, assuming for convenience the same shaft horsepower and speed as before and using the ships from columns 11 and 13, Table III.

TABLE IV.—CUBIC SHIP (at about ⅔ capacity).
10,000 Mile Voyage

	Motorship	Steamship
Days on run + 5 percent	41.6	41.6
Days in port + 10 percent	8.8	8.8
Days per voyage	50.4	50.4
Voyages per year	6.65	6.65
Initial cost of ship	$600,000	$300,000
Present value per gross deadweight ton capacity	$61.80	$30
Tons carried per year	40,000	40,000
ANNUAL EXPENSES		
Capital charges (Table III)	$150,000	$87,000
Fuel used at sea and in port	45,500	100,500
Lubricating oil and fresh water	6,200	4,300
Wages of crew	37,500	37,500
Subsistence of crew	8,500	8,500
Tonnage dues and port charges	17,900	17,900
Brokerage and management	20,000	20,000
Stevedoring	56,000	56,000
Annual operating expenses	$341,600	$331,700
Rate per ton to give 10 percent return on investment	$8.50	$8.30

The results in the above comparison are very interesting. The motorship, which with a full load could carry cargo at a rate 5 percent less than the steamship (columns 11 and 13, Table III), must charge a rate 2½ percent higher than the steamship when working as a cubic ship or when not loaded to full capacity as a deadweight ship. (As already pointed out, the steamship will lose some cargo space on this extremely long voyage because all of the fuel and feed water cannot be stowed in the double bottom. This will reduce the above ratios slightly for a cubic ship.) In this comparison in Table IV neither the increased weight of the Diesel machinery nor the reduced weight of fuel and water have any influence except a slight effect on the displacement and shaft horsepower. The reduction in shaft horsepower due to difference in fuel-water weights is about 6 percent, which will reduce the operating expenses by less than 1 percent.

To appreciate the advantage of the motorship on the long voyage with full cargoes, the cargoes carried per year should be compared (line 15, Tables II and III). On the 5,000 mile voyage the motorship carries 3,000 tons (3.4 percent) more cargo per year than the geared turbine and watertube boiler ship and 5,500 tons (6.4 percent) more than the reciprocating engine ship. On the 10,000 mile voyage (line 15, Table III) the increased carrying capacity of the motorship is 12.2 percent more than the watertube boiler ship and 17.4 percent more than the ship with Scotch boilers.

DIESEL-ELECTRIC DRIVE

If a Diesel electric installation is used, the weight of the installation will be slightly less than that for the ship with reciprocating engine and Scotch boilers, i.e., 470 pounds per shaft horsepower of the propelling motor. The fuel consumption in service will be between 0.46 and 0.50 pound per shaft horsepower of the propelling motor or about 10 percent higher than that of the direct connected Diesel installation. The space occupied by the machinery will be about the same as the direct Diesel installation and perhaps slightly greater. The net result will be about the same cargo deadweight as the motorship with direct connected Diesel engine. The cost of conversion is problematical. Due to the smaller engines and higher revolutions per minute used, the Diesel machinery will be considerably cheaper. If the electrical cost can be kept down, the Diesel-electric drive offers possibilities. However, for the cargo ship many of the excellent advantages of the Diesel-electric drive, such as ease of control, good economy at reduced speeds, etc., offer no special attractions.

TWO CYCLE ENGINES

The comparisons given above are for ships fitted with four cycle engines. If two cycle engines are used, the machinery weights will be reduced and the increase in fuel consumption will not be appreciably greater. Due to the smaller number of cylinders and reduced weight, the first cost of the main engines should be between 10 and 25 percent less than for the four cycle installation. The motorship with two cycle engines theoretically should be superior to the one with four cycle engines but probably more depends, in the present stage of development, on the particular make of engine rather than on the cycle.

The foregoing calculations are not intended to prove the superiority of any of the types discussed. An attempt has merely been made to present the problem that is attracting so much present day attention in as clear and fair a light as possible as a guide to shipowners who contemplate buying some of the war-time ships.

The writer is aware that his assumptions and data are not the same that everyone approaching the problem would use. There are so many possibilities for changing the assumptions and data here and there that no two could agree in all the details. Yet the broad conclusions reached are comparable and any changes can readily be made in the first cost, depreciation, insurance, etc., to investigate any special case.

Exports Drop: Imports Increase

THE quantity of our ocean-borne imports is steadily increasing and that of our out-bound commerce is as steadily falling off, according to a statement just issued by R. T. Merrill, director, Bureau of Research, United States Shipping Board. The Bureau, in making public the results for the calendar year 1922 and in comparing these results with those of 1921, makes the following comment:

The total export commerce of the United States, exclusive of that moved upon the Great Lakes, has in the last year decreased by 5,500,000 tons while the inward-bound business has increased almost 10,000,000 tons. The total commerce therefore of the United States has increased by over 4,000,000 tons.

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Punishments of Merchant Seamen

Changes in Penalties for Crimes and Offenses—Existing Laws Which Affect the Discipline and Economy of a Ship

By Wendell Phillips Raine, M.A., LL.B.*

FROM the days of Jonah to the present time much has been written concerning merchant seamen, and everyone is familiar, through history and story, with the hardships and the horrors of the mariner's life and with the harsh punishments that would be meted out to him for the commission of crimes and offenses.

A hundred years of our own history showed surprisingly slight modification in the severity of statutory penalties and in the decisions concerning the masters' right to enforce discipline. The seamen were little better than slaves. The turning point in their emancipation dates from the passage of the White Act, December 21, 1898. Even as late as 1910, however, the Seamen's Union, in a petition to Congress, decried their unjust treatment. And today, although the Seamen's Act (March 4, 1915) went far towards removing the most gross injustices, there are many who believe that the punishments for certain offenses are still extraordinary and unjust.

It is the purpose of this paper to consider the changes in penalties and punishments since the first congressional statutes of 1790; to show to what extent they were little by little modified; and to present the existing law. It will not discuss such crimes as murder, rape and others of personal character but will confine itself to the following offenses—offenses which "affect the discipline and economy of the ship": (1) The destruction of the ship by arson or in any other way; (2) piracy; (3) mutiny; (4) damaging of the ship or its cargo or embezzlement of the cargo; (5) smuggling; (6) assault; (7) disobedience and negligence; (8) drunkenness; (9) desertion; (10) absence without leave; (11) quitting the ship on arrival at port.

The first three are of grave criminal nature, and are, therefore, the least unjust in the severity of their punishments. The next five in order are also felonious in character, though to a lesser degree, and they, too, will seem to necessitate punishment of a more severe nature than the last three offenses, which are questionably offenses at all, and the punishments for which have received the most severe condemnation. The advance made in the treatment of the first eight, although slow enough, is in line with the advance made in criminal law; but the penalties inflicted for desertion and its sister offenses, having no model and being peculiar to merchant seamen, show less change and are more objectionable.

Early Capital Offenses

For the first three crimes—including arson, destruction of the ship, piracy, and mutiny—our first criminal law, April 30, 1790, provided the death penalty. Attempted piracy and attempted mutiny were punishable with three years' imprisonment and a fine not exceeding a thousand dollars. There was no relief in the severity of these punishments until 1835, when mutiny was removed from the list of capital offenses, and made punishable by 10 years' imprisonment at hard labor and a fine of two thousand dollars, and attempted revolt with imprisonment for five years or a fine of a thousand dollars or both. In fact, it is to be observed that attempted mutiny might receive even more drastic punishment than was provided for in the earlier statute.

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There was little or no further change in these punishments until the passage of the Act of March 4, 1909—"an act to codify, revise, and amend the penal laws of the United States." Its most striking characteristic is the abolition of the death penalty for all types of crimes with which this paper deals, and the substitution of imprisonment and fines. A pirate is imprisoned for life, the most drastic penalty for the crimes under discussion. Likewise, arson, or the destruction of the ship by other means, no longer is punishable with death, but with a fine not to exceed five thousand dollars and imprisonment not to exceed 20 years. The punishments for mutiny and attempted mutiny are simply re-enactions of the provisions given above according to the Statute of 1835, the words "at hard labor" being omitted from the act of 1909.

Grave Offenses Against the Ship

Among the next group of offenses—damaging of or embezzlement of the ship's cargo, smuggling, assault, disobedience or negligence, drunkenness, all offenses of a criminal character, both embezzlement and smuggling have been regarded, first by the general maritime law, and then by recent statutes, as among the grave offenses which a mariner can perpetrate against the ship. There has been not the slightest modification in the three statutes which deal with the subject. The Acts* of 1872, 1898, and 1915, all read in the same way, and are in line with the earlier court decisions.

For damaging the ship or its cargo or for the embezzlement of the cargo or any part of it, the seaman shall forfeit from his wages "a sum equal in amount to the loss thereby sustained," and also, at the discretion of the court shall be imprisoned for not more than 12 months. If a seaman is convicted of smuggling, "whereby loss or damage is occasioned to the master or owner, he shall be liable to pay such master or owner for such loss or damage; and the whole or any part of his wages may be retained in satisfaction or on account of such liability; and he shall also be liable to imprisonment for a period of not more than 12 months."

Assault, disobedience or negligence, drunkenness have particular interest because maritime law from its beginning has approved for them the application of corporal punishment by the master. The apparent need for the master to punish one who assaulted him or attempted to assault him early became one of the customs of the seas. The kind of corporal punishment inflicted varied with the seriousness of the offense and the character of the master. Yet the courts were likely to uphold the action of the master on the score of discipline.

Disobedience, without assault, or negligence of a gross kind had also been deemed offenses within the province of the master from the most remote period of maritime law. The master had supreme authority on board his vessel. He could inflict proper correction on his crew, both for past and present offenses; he had to have authority to enforce the discipline of the ship. Corporal punishment was the instrument best suited to accomplish that result. Flogging was usual. The readers of "Two Years Before the Mast" will remember

*Shipping Commissioners' Act; the White Act; the Seamen's Act.

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that horrible as flogging seemed to the author, he questioned the expediency of abolishing it. Only a few years after the publication of that book, however, Congress abolished such punishment. No doubt, it savored too much of the kind of thing the Northerner was denouncing in connection with slavery; and so, almost accidentally, and altogether incidentally, corporal punishment received its death blow. The circumstances are, perhaps, not generally known.

CORPORAL PUNISHMENT ABOLISHED

In the first session of the Thirty-first Congress, the advocates of the abolishment of flogging could get little attention. It looked as if the reform would not be accomplished. Finally, its upholders refused to support an admiralty bill arranging for the transportation of mails between various American and foreign ports, unless there were appended the following provisions: "That flogging in the navy and on board vessels of commerce, be, and the same is thereby, abolished from and after the passage of this act." (September 28, 1850.) Almost 50 years passed, however, before flogging and all kinds of corporal punishments were done away with by statute, and before there was, therefore, any provision for the punishment of a master who violated the law.

The earliest statute to deal specifically with these offenses, the Act of 1872, harsh as it will be seen to be in many ways, provided substitutes for corporal punishment. It meted out heavy penalties, choosing imprisonment as its instrument of punishment, but it did afford means for depriving the master of much of the summary justice he had been wont to inflict, and so marked a step in advance.

PENALTY FOR ASSAULT

In the case of assault the legislation of 1872 still stands, the later statutes of 1898 and 1915 re-enacting it word for word. The penalty for assault is still two years' imprisonment.

The Act of 1872 likewise made the first statutory provision for disobedience and neglect under two headings; wilful disobedience; continued wilful disobedience. For the former the seaman was subjected to not more than six months' imprisonment and a forfeiture of not more than four days' pay, the forfeiture of wages being at the discretion of the court. For the latter, the imprisonment was not to exceed six months, but was to involve either a forfeiture of 12 days' pay for every 24 hours of continued disobedience or neglect, or sufficient to defray any expense which had been properly incurred in hiring a substitute.

The Act of 1898 was a reversal and a modification of the earlier statute in that it made forfeiture of wages, for both wilful disobedience and continued wilful disobedience, the real penalty—the forfeiture of four days' pay for the former, and of 12 days' pay, or defraying of expenses, for the latter. Imprisonment was at the discretion of the court, but for only one month in the first instance, and for three in the second.

Whereas the Act of 1872 is important because it lessened the arbitrary power of the master, it was nevertheless harsh in its penalties, especially in its stress upon imprisonment in addition to fines and forfeitures. It is the Act of 1898 which reflected a fairer, a juster legislation. It deprived the master of the right to inflict punishment, but it did allow him to keep the culprit in irons, on bread and water, until a cessation of disobedience, or until the ship arrived in port, with full rations every fifth day. The Seamen's Act reaffirms all these provisions. It is no longer possible, then, for the master to inflict corporal punishment except for mutiny, and then only as a last resort. A seaman may be confined until he reaches port, but his actual punishment rests with the courts.

DRUNKENNESS

Drunkenness, in its results, was always recognized as a serious menace to the discipline of the ship. Other offenses, already discussed, often were traceable to drunkenness, although the punishment inflicted was for the offense and not the cause. But the Act of 1872 regarded drunkenness as an offense in itself, not fully covered by other provisions, and made it a misdemeanor punishable with 12 months' imprisonment, if a seaman because of his drunkenness committed any act "tending to the immediate loss or destruction of, or serious damage to such vessel, or tending immediately to endanger the life or limb of any person belonging to or on board such vessel." The present Seamen's Act reaffirms this law.

There seems to be no reason for modifying the punishment for an offense that may be so serious in its effects. In general, however, as one reviews the trend of legislation for these first eight offenses one finds the trend towards alleviation and moderation. Capital and corporal punishment have disappeared; terms of imprisonment have in many instances been shortened; fines and forfeitures are the most usual punishments.

GREATEST EVILS REMOVED BY EXISTING LAW

There is not, as far as the writer can learn, any longer any serious quarrel on the part of the seaman regarding the recent laws for the crimes and offenses already discussed. The greatest evils have been removed. The seaman must admit the necessity for punishment of crimes and offenses that are crimes and offenses on land or sea. The existing penalties are not peculiar to the sea service. That they seem more flagrant because the seaman has promised in his contract not to commit them, does not mean, as far as the existing penalties are concerned, that the punishments are in consequence more severe. His contract merely emphasizes to him the necessity of conduct in accord with the discipline and economy of the ship.

While the mariner's contract is fundamentally the same in principle as any land contract, yet it presents some fundamental differences. First, the seaman can be made to complete his contract, whereas the ordinary contract merely permits the injured party to sue the injuring party for any damages he can prove he sustained. The mariner's contract is more like that type of land contract where equity courts will compel specific performance on the part of the delinquent —contracts, for example, for the sale of land or of chattels of a peculiar personal value, unobtainable elsewhere. Secondly, the mariners' contract is the only contract known to the common law in which the employer, by his own act, can directly inflict a punishment on the employed, for neglect of duty and breach of contract. These peculiarities of the mariners' contract, traceable in all their contracts from ancient times to the present day, are, of course, owing to the necessity of having the seaman bound absolutely to the ship for the period of his engagement, and of having him absolutely dependable during such service.

But the sailor regards himself to all intents and purposes a slave. Especially does he feel the shackles of slavery because he cannot desert, or leave the ship, or quit it in port, without being punished for so doing. His contention is that he is merely breaking his contract and that he is liable only to the extent of damages incurred. The master, on the other hand, may regard any one of these three defections as more detrimental to the discipline and economy of the ship than the actual offenses—violation of the moral law—for which he is punished not because he has violated his contract, although he has done that too, but because he has already committed a wrong.

DESERTION

The most serious offense he can commit, from the master's point of view, is desertion. Desertion is defined as the act by which a seaman deserts and abandons a ship or vessel in which he has engaged to perform a voyage, before the

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expiration of his time, and without leave. It is more than a mere unauthorized absence from the ship without leave. It carries with it the intent not to return to the ship's service. Although there are circumstances that justify the leaving of the ship—*sickness, unwholesome food, cruel treatment, deviation in the route, unseaworthiness of the craft—in all cases the justification must be clearly shown, †and no slight pretext can be admitted, such as bad food on a certain day, or a possible leak, or the infliction of moderate chastisement because of the disobedience of orders.

The first Congressional Act (July 20, 1790) relating to the last three offenses of seamen—offenses not criminal in character—provided, in accord with the general maritime law, the following punishments for desertion: (1) The forfeiture of all the wages due the seaman, all the goods and chattels left on board ship, and the payment of damages if any such had been incurred by the master in hiring another mariner; or (2) his forcible apprehension by a justice of the peace at the request of the master. In other words, he paid an enormous penalty; or he was arrested and imprisoned until the vessel sailed.

The law remained practically unchanged until the Act of June 7, 1872. This was in no sense a modification of the Act of 1790, but rather an extension of it, and in general harsher in its penalties. It had, as has already been seen, an obsession for imprisonment as a punishment. The deserter was to suffer imprisonment for a period not exceeding three months, and in addition to forfeit his goods and chattels as well as the wages due him. He did not pay damages in addition to the above, but that was his only immunity, and the cost of such immunity was imprisonment. A backward step had been taken; the status of the seaman was worse than ever; and even though this act provided for commissioners that were to protect his interests, he continued to be punished for breaking his contract, and more severely punished at that.

The coastwise vessels received the first relief; in 1895††, seamen engaged in such traffic were exempted from the penalty of imprisonment. And in 1898, in the first act that frankly endeavored to better merchant marine conditions, seamen deserting in a home port did not suffer imprisonment. Finally, in the Act of March 4, 1915, imprisonment was abolished altogether as a penalty for desertion—a noteworthy advance after more than a century of seizures and imprisonment.

At present the deserter forfeits all or any part of the clothes or effects he leaves on board, and all or any part of the wages which he has earned. The greater justice of his present status is evident. He cannot be seized; he cannot be imprisoned. Yet the anomaly still remains that he is penalized for breaking his contract. Instead of paying damages, he forfeits his wages and his belongings, regardless as to whether the loss to the ship is greater or lesser than the amount forfeited. Perhaps, with the increase of available seamen, future legislation will allow him to collect his earned wages and to secure his personal effects, and will make him liable for damages alone. When that happens, desertion will no longer be listed among the offenses of merchant seamen and punished as such.

Absence Without Leave

Second in gravity, to the master assembling his crew, is the failure of the seaman who has signed shipping articles to go aboard the ship, or his absenting himself without leave after he has already gone aboard. For the former, the Act of 1790 provided that the seamen's contract should state, in writing, precisely the day and hour on which he was to go aboard his vessel, and stipulated that if he were tardy he was to forfeit one day's pay, and that if he failed to go aboard at all, so that the ship proceeded without him, he was to lose the money already advanced him, together with a sum equal to the amount of the money so advanced, this amount to be secured through any court, or before any justice of the peace in the United States having cognizance of such cases. For the latter—absenting himself without leave—he was fined three days' pay for each day he was away, provided he returned by the end of the second day, or within 48 hours, the sum to be deducted from his wages.

The harshness of this act was in no way relieved by the Act of June 7, 1872, any more than were the provisions for desertion. First of all, the two offenses, that of failure to join the ship and absence from the ship without leave, were included in the same provision, and were made punishable with one month's imprisonment. There was no escaping of the imprisonment. At the discretion of the court the seaman might also forfeit two days' pay, and for every 24 hours of absence, a sum not exceeding six days' pay, or an amount that would cover the expenses of hiring a substitute. The spirit of the Act of 1872 is the same whether it relates to desertion or absence from the ship. Severity of penalty to stop desertion and kindred offenses marks its every article. In short, the penalty made profit out of the seaman's breach of contract, and imprisoned him at the same time.

Relief came to the absentee seaman and to the seaman who failed to join his ship in 1898, as it did for the deserter. It distinguished between the offense in a (1) home port or in the domestic trade, and (2) foreign trade in a foreign port. For the first, imprisonment disappeared, and the seaman forfeited two days' pay, or an amount that would cover the expenses of hiring a substitute. If the offense occurred in a foreign port in the foreign trade, he might be imprisoned for a month, or forfeit two days' pay. The Seaman's Act (1915) did away with imprisonment altogether, retaining only the provision for the two days' pay, thus putting the seaman's contract in this respect very nearly in the class with any other type of contract.

When one breaks the terms of one's contract, one is liable to the injured party for whatever the injured party has suffered. Under the Seaman's Act, the remission of two days' pay seems a reasonable amount to regard as payment for damages; and it can very well be regarded as a payment for damages instead of a punishment for a criminal offense. It established a precedent which can be employed in the future in determining the penalties for the other offenses which are merely violations of the contract and not criminal in character.

Desertion and quitting the ship in the home port will have to receive similar treatment. For the last named offense, there was no legislation until the Act of 1872, which provided for the forfeiture of a month's pay, a law which has been reaffirmed and is incorporated in the Seaman's Act.

Immediate Modification of Existing Laws Unlikely

It is unlikely that there will be any immediate modification of the existing laws regarding the offenses of merchant seamen. No other country, excepting Australia, has granted so much to the mariner. As one surveys our whole shipping history, he realizes how much has been gained. Capital punishment has been abolished; corporal punishment has been abolished; seizure of a seaman is no longer possible; imprisonment terms have been reduced; and fines and forfeitures are now equitably adjusted to the actual loss incurred. Yet the seamen hope for more. Even admitting the necessity for punishment in the case of wilful disobedience, they regard the confinement in irons on bread and water as a form of punishment tyrannous and exceptional,

(*Continued on page* 146)

*Fed. Ces. No. 2953 D. C., 1871; No. 13,697 D. C., 1799; No. 4032 D. C., 1830.

†116 Fed. 212 D. C., 1902.

††The Maguire Act.

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British Shipbuilding Outlook Much Brighter

Number of Laid-Up Vessels Continues to Decrease, British Idle Tonnage Has Been Reduced 45.7 Percent During Past Year

By W. H. Wendon

THE outlook for British shipbuilding, and that of allied industries, is brighter than at any time since the great slump set in. Shipowners in all quarters of the United Kingdom are taking their courage in their hands and are placing orders which will keep many yards busy for the remainder of the current year. Vessels of all types are included in this accretion of contracts, from the stately liner to the ubiquitous "tramp."

This happier frame of mind on the part of shipowners has come about only after protracted study of the world-wide shipping and trading situation. And in this regard the views of the experts differ widely as to the wisdom of giving out contracts for new tonnage. Indeed, in at least one notable instance, optimism and the placing of orders for new vessels certainly do *not* go hand in hand. Messrs. Furness, Withy and Company are to increase their fleet by four large Diesel-engined vessels, but as against this interesting fact, Sir Frederick Lewis, the chairman of the Furness, Withy Line, and whose experience in the shipping trade covers a vast field, is of the view that the trading outlook at the moment is difficult and uncertain, and that it must continue so until international trade can be encouraged and developed by an absence of political disturbances and some attempt made at stabilization of exchanges.

Pioneers Needed

As has been the case for a long time past, what has been most needed in order to give the shipbuilding industry a fillip has been shipowner "pioneers," and more particularly is this the case in regard to Diesel ships, which, although increasing in numbers and in size, are still to many an unknown quantity. It is a case, speaking generally, of their not having been tried to ascertain if they are wanting. At least one prominent shipping man has been frank enough to admit the absence of this pioneering spirit in regard to Diesels, although at the same time his company has, in conjunction with an allied undertaking, shared a contract for a new boat with reciprocating engines. Sir Laurence Philipps, chairman of the Court Line, an old-established and well-managed cargo boat concern which has distributed 20 percent per annum to its shareholders of late years, is the authority to whom I am referring. He and his co-directors have considered the whole shipping situation, and have come to the decision that they would not be justified at the present moment in contracting for many new boats, but they think things are, by comparison, so much cheaper that they cannot hurt themselves by having a steamer, or at least a share in one.

Sharing the Risk

So, as I have hinted, they are forming a subsidiary company—the United British Steamship Company, Limited—and have gone in with the Cressington Steamship Company, which is under the same management, and in this new company they have put up the capital between them. They have ordered a steamer which they think, in the long run, will make money; but the nice point arises: Have the directors got in "at the bottom?" This phase is uppermost in the minds of shipowners at the present time. Many feel that by refraining from contracting now, they will ere long be able to secure new tonnage a little—some say a lot—cheaper. At all events, the Court Line, in their new venture, admit that it is quite possible that they have not got in at the bottom, but at any rate they have shared the risk, and they consider they have not much to lose. It is, perhaps, not a little singular that, while the company is thinking of new tonnage, even though it be on a small scale, the chairman cannot see that we have yet passed the worst; but, as bad times cannot be expected to go on for ever, he is apparently content to think and believe that good times will be restored some time in the future.

Reverting to Diesels, the Court Line directors, in fixing the type of vessel to be contracted for, considered whether they would build a vessel with Diesel engines, but they came to the conclusion that, while there were many advantages in this method of propulsion, they would rather, for the present, look on, until they could be certain from other people's experience that they were absolutely suitable to their type of vessel. In common with many other owners, however, they will watch carefully the development of internal combustion engines for marine purposes.

So much for the views of those who are inclined to pessimism. In far more hopeful frame of mind is Sir William Noble, an ex-president of the Chamber of Shipping of the United Kingdom, and a successful shipowner at that—who manages the well-known Cairn Line of Steamships, Limited. Much value is detracted from Sir William Noble's bright outlook, however, by the fact that, so far as I am able to learn, he is not backing up his opinion to the extent of contracting for new tonnage—at all events, not on a large scale. However, he sees in the present position qualifications which enable us to look to the future with hope, even if the present is enshrouded in gloom, that is, were there nothing to qualify the unequal balance between the amount of world tonnage and the volume of world trade.

Inefficient and Obsolete Vessels Are Unemployable and Unsalable

The first of Sir William Noble's "qualifications" is that in the world's merchant fleet today there are many obsolete vessels, more than in ordinary times, owing to the Great War. Of vessels of over 25 years of age there were on a recent date no less than three and a half million tons, while there are probably two million tons more unaccounted for in Lloyd's classification. These vessels are inefficient and uneconomical, and can never expect to trade again. They will have to be scrapped and, in Sir William Noble's view, they should, in the interests of efficiency, be scrapped. My authority then deducts three and a half million tons as representing the tonnage of oil tankers, as these vessels do not come within the orbit of the ordinary freight market, and he asks: "Is it not proper to deduct a certain proportion of the American war-built fleet, which, though not old, is yet regarded as inefficient, and is now unemployable and unsalable?" He takes into consideration, also, the three million tons estimated to be included in this category, "and which the United States Shipping Board may have to wipe off." Finally, Sir William Noble reasons from the foregoing that we have a total of about twelve million tons which may be deducted from the world's excess of fifteen and three-quarter million tons, leaving an actual excess of effective world tons amounting to well under four million tons, and he concludes

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that, once shipowners realize that the excess of effective world tonnage is reduced to this figure, they can take heart of grace again. Sir William Noble's deductions should inspire confidence in the minds of his fellow shipowners, many of whom would, however, feel further convinced were he to give a lead in the matter on behalf of his company.

Reduction in Laid-up Tonnage

Confirmation of the brighter feeling in United Kingdom shipping circles taken as a whole is forthcoming from the statistics of laid-up British and foreign tonnage at the 36 principal ports of the United Kingdom. The tables, which are compiled by the Chamber of Shipping of the United Kingdom, and are, therefore, reliable, bring the position up to January 1, 1923, and reveal that, as compared with October last, there is a fall of 11.2 percent in the amount of laid-up tonnage, and since January 1, 1922, a decrease of no less than 45.7 percent. The total number of vessels laid up a year ago was 712, of 1,307,593 tons net. On October 1, 1922, there were 456 vessels of 824,624 tons and on January 1 this year 411 vessels of 732,198 tons. That such a vastly increased quantity of merchant shipping should now be finding employment—of, it is to be presumed, a remunerative nature—in comparison with twelve months ago lends weight to the feeling that better times are with us. With better times for shipowning, so must there be more work for shipbuilders—at all events, that is the lesson of the past.

Wage Adjustments Have Increased Demand for Tonnage

Lower wages have been a factor of great importance in contracts which have lately been placed with United Kingdom shipbuilders. As is now a matter of history, the main point of controversy between shipbuilders and their men was as to whether the 26s. 6d. a week war bonus should be abolished. Negotiations with a view to its extinction proceeded for many months, notwithstanding that before the employers decided to withdraw the remaining ten shillings of the 26s. 6d. it was patent to all in the industry that the prevailing high costs of production were bringing the trade to a standstill. With a comparatively amicable wages adjustment, however, the industry was again set going and orders were distributed with refreshing frequency.

The extent of the increased demand for new tonnage is plainly discernible in official statistics recently compiled. Thus, 78 vessels of 231,187 tons gross were commenced in the quarter ending December 31 last, as against only 55,290 tons in the corresponding period of the previous year. A slight reduction took place in the first quarter of 1922, and a still lower level—38,877 tons—was reached in the succeeding quarter. The third quarter of the year, however, showed an increase of about 44,000 tons, while in the final three months the total reached up to within 30,000 tons of the tonnage placed in the water. While this is, of course, by no means "boom" time progress, it is, in all the circumstances, an encouraging feature. Furthermore, a fair proportion of the vessels contracted for since the revival set in would not have been commenced in time to be included in the figures which I have quoted, so that the position is to that extent better than appears on the surface.

Two Shipyards Reopen

Two shipbuilding yards, each of which has been closed for many months, are to reopen. One belongs to the North of Ireland Shipbuilding Company, of Londonderry. The other is the River Clyde Shipbuilding Works at Whiteinch, Glasgow, which were owned by the Lloyd Royal Belge, of Antwerp. The Glasgow property has been acquired by the Australasian United Steam Navigation Company, Limited, of which Lord Inchcape, the head of the P. and O. Company, is chairman, and it is expected that the works will be reopened shortly and operated by a well-known firm on the Clyde. A few years ago the yard turned out quite a large number of vessels for the Belgian steamship company by which it was owned, but, with the increased cost of production and difficulties owing to the Belgian rate of exchange, the yard was compelled to close down. The steamship company, incidentally, has also experienced hard times owing to the depression, and has, in fact, recently disposed of many of its large and newly-built steamers, at, of course, a mere fraction of the boom-time sums paid for them.

Status of Government Merchant Fleet

J. Barstow Smull, president of the United States Shipping Board Emergency Fleet Corporation, has made public the following status of the Government fleet:

ASSIGNMENT OF SHIPPING BOARD TONNAGE TO TRADES FOR THE MONTH ENDING DECEMBER 31, 1922

Trades	Number Vessels	D. W. T.	Percent
U. S. Government—			
Army Service	1	10,013	0.30
Northern Europe—			
United Kingdom and Ireland	77	654,197	19.84
Bordeaux-Hamburg Range	93	834,319	25.30
Scandinavian and Baltic	12	88,397	2.68
Total	182	1,576,913	47.82
Southern Europe—			
Span. Atl. and Portuguese	3	23,214	0.70
Span. Mediterranean	5	40,467	1.23
Fr. Med., W. C. Italy and Adriatic Sea	13	103,917	3.15
Greece and Black Sea	18	140,967	4.28
Total	39	308,565	9.36
British India	7	65,720	1.99
Australian	12	107,717	3.27
Hawaii	2	25,384	0.77
Orient	50	530,432	16.09
Dutch East Indies	5	44,702	1.36
Total	76	773,955	23.48
Africa—			
East Coast, So. Africa	6	52,901	1.60
West Coast of Africa	5	43,088	1.31
Total	11	95,989	2.91
South America—			
East Coast	33	287,604	8.72
West Coast	7	43,663	1.32
Total	40	331,267	10.04
West Indies and Caribbean	13	54,247	1.65
Foreign Service	14	77,283	2.34
Domestic—			
Coastwise	4	16,716	0.51
Intercoastal	6	52,503	1.59
Total	10	69,219	2.10
(A) Total	386	3,297,451	100.00
(A) Total does not include:			
Steel vessels tied up	874	5,585,166	
Wood vessels tied up	6	24,386	
Concrete cargo tied up	2	6,078	
Vessels chartered to Independent Companies	10	35,031	
*Tankers	87	784,785	
Under custody of U. S. S. B. as mortgagee	2	16,621	
Awaiting orders of reconditioning	1	15,000	
Awaiting assignment	9	69,545	
Awaiting delivery to purchaser	1	5,610	
Contract cargo-unfinished (steel)	1	9,400	
†Grand total	1,379	9,846,611	

*Includes 7 concrete tankers of 48,783 D. W. T.
†Does not include 6 Army transports of 38,235 D. W. T., title to which is vested in Board, although physical delivery to Board has not been effected.

Punishments of Merchant Seamen

(*Continued from page* 144)

though preferable to the corporal punishment for which it was substituted. A still worse form of slavery exists, they contend, as regards the penalties for desertion. Unlike other workmen, they are deprived of wages which they have already earned, not because of any criminal offense but because they have broken their contract.

To be forced by a criminal prosecution to fulfill their contract is the present grievance of the merchant seaman. They will regard themselves as really emancipated only when the three so-called offenses of desertion, absence without leave, and quitting the ship at the home port are deemed no longer offenses, but simply violations of a contract.

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Recent Developments in Marine Insurance

New War Risk Demand—Shipping Board Boats Re-rated—Scuttlers and Mortgagees—New Syndicate Agreement—Absolute and Constructive Total Losses—Average Settlements

By "Bordereaux"

ONCE again the voice of the war risk insurer is heard in the land. The dread possibilities of France in the Ruhr, and the delicacy of the Near East situation with the war-loving Turk glooming in his tent, have had their effects upon shipping psychology. There is a renewed market for war risk insurance, and a very respectable volume of it is being written under open policies. Apprehension is felt in America for goods ashore in Germany; and especially by the American underwriter, because much of it has been covered in this market against strikes and civil commotion—and what is more likely than these kinds of disturbances in event of an uprising against the present German Government? London has shared in the war risk revival. She had to first go through her usual pow-wows between the companies and Lloyd's, to hammer out an agreement; after which concerted action prevailed. The Free of Capture and Seizure clause and the Strikes, Riots, and Civil Commotions clause were reinstated in all policies on all interests to or from or in or through Germany (exclusive of the occupied territory), and on all interests in German bottoms for whatever voyage. These risks excluded by the F. C. S. and the S. R. C. C. clauses are held covered subject to forty-eight hours' notice for cancellation at a premium to be arranged. The American rate is practically the same as the British rate, with the exception that our quotations are for "waterborne only," while theirs includes ten days on shore. The Institute of London companies' war rates are as follows: "To or from German ports, on German steamers, bound out, ten shillings; bound homewards, fifteen shillings. On other steamers, bound out, two shillings and sixpence; bound homewards, five shillings. Outward voyages carry a ten days' sailing warranty."

The Scuttler and the Mortgagee

MUCH has been written about the status of the innocent mortgagees in maritime transactions, and the matter appears to be by way of a drastic settlement in England where underwriters have more than once paid the penalty of sympathy with the man who loaned money on a ship that was later sent to the bottom with the connivance of its owner and master. The courts are always dodging the issue, in that they do not come out with a clean-cut decision pronouncing scuttling or casting-away a peril that was not insured against. Unless British underwriters get a clear court ruling on the subject they will very likely draft a clause for inclusion in all policies on mortgaged steamers excluding payment of losses caused by deliberate scuttling or casting away. It is admittedly a hardship to withdraw insurance protection from innocent third parties, such as mortgages may frequently be, but still it is felt to be imperative that the principle be established that in no instance whatever shall an underwriter be called upon to pay a loss on a vessel which has been fraudulently cast away with the privity of the owner. Even if the law remains unaltered it is regarded as impolitic to continue to cover innocent mortgagees, as to do so would be to encourage mortgagees to take risks in advancing money to persons of doubtful integrity, since they would be assured of protection in event of fraudulent loss.

In two important cases the English Court of Appeals recently sustained the underwriters' appeals, in instances of this kind, but the ground of scuttling not being a peril insured against was not established. One of these, the *Grigorios* case, was won on the point that the warranty concerning the amount of insurance on disbursements had been broken. The other, the *Joanna* case, went the underwriters' way because the mortgagees were shown to have had no independent interest in the insurance.

Additional Shipping Board Re-ratings

TWO more shipping lines have been recommended to underwriters for improved cargo ratings by the Conference Committee whose report of October 20 last was at the time believed by many to be final. These additions have just been made:

(1) That the Cosmopolitan Shipping Company, operating out of New York to Havre, Dunkirk, Bordeaux and St. Nazaire, in so far as tonnaged by approved United States Shipping Board steamers, be granted the same classification as any of the following competing lines: Roosevelt Steamship Company; Sir W. Reardon Smith & Sons, Ltd.; Lloyd Royal Belge.

(2) That Swayne & Hoyt, Inc., operating out of Pacific ports of the United States to East Coast of South America, via Panama Canal, in so far as tonnaged by approved United States Shipping Board twin screw passenger steamers not over twenty years of age, be granted the same classification as the twin screw passenger steamers not over twenty years of age operated by any of the following competing lines: Nippon Yusen Kaisha; Osaka Shosen Kaisha; Toyo Kisen Kaisha; and that in so far as tonnaged by other approved United States Shipping Board owned steamers it be granted the same classification as similar steamers of the same competing lines.

NOTE: As it is contemplated by the Shipping Board to tonnage this line with passenger steamers, the service should be distinguished from other services tonnaged by cargo steamers only.

Marine Syndicates' New Agreement

THERE went into effect at the beginning of the present year a further amendatory and supplemental agreement between the United States Shipping Board, the Emergency Fleet Corporation and the subscribers to Syndicate A of the American Marine Insurance Syndicates. Under the provisions of the original agreement, entered into on June 28, 1920, the two former parties were required to appropriate the sum of $1,000,000 as a working fund from which payments might be made to the Board of Managers of Syndicate A subscribers from time to time in installments as the Board might certify to be required, and in addition to make quarterly advances in the amount of $250,000 each on account of the operating expenses of Syndicate A. The Shipping Board has advanced $500,000 of this amount, but not the quarterly advances because the Syndicate managers did not need them. By the agreement the unexpended balance of the $500,000 is to be returned to the Board not later than December 31, 1923. When the United States Salvage Association was organized the agreement was amended, effec-

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tive as of July 1, 1920, permitting the subscribers to employ the Salvage Association to perform the services stipulated to be rendered by Syndicate A. In the prevailing depressed condition of shipping and commerce advances in the amounts originally provided for are not now needed for the operation of Syndicate A; hence the new agreement.

Under the new arrangement a balance of $125,000 of the $500,000 already paid in is to be retained by Syndicate A subscribers as an operating or "revolving fund." A plan of monthly settlements has been arranged, the subscribers rendering to the Shipping Board or Emergency Fleet Corporation bills, on the last day of each month, for services performed during such month, itemized so as to show the charge made for the account of each vessel. The work so done is understood to be at cost, so that there shall be no profit nor loss to the Syndicate A subscribers or the United States Salvage Association. These bills are to be paid by the Board or Corporation within thirty days from receipt thereof. These service expenses are to be paid out of the revolving fund, which the Board or Corporation bind themselves to repay so as to keep the fund at $125,000.

Norwegian Mine Clause Canceled

NORWAY discontinued writing war insurance at the beginning of the year, and the Central Union of Norwegian Marine Insurers, as a consequence, declined to include after that date its eventual mine risk clause in ordinary hull policies. With the restrictions created by the Norwegian marine insurance plan of 1907 the liability of the marine underwriter included the consequences of risks caused by mines laid during the great war of 1914-1918. It is now up to the underwriter to prove that the loss eventually is caused by mines not laid during the great war. Unless special agreement is made at the inception of each individual voyage, the underwriter cannot be held for such mine risks, if the vessel journeys to Russian ports in the Black Sea, the White Sea, or seas affected by a new war or new preparations for war. Underwriters admit that mines have always been supposed to become harmless after floating for a year or two, and yet the Germans appear to have built mines that remain as dangerous as ever long after they should, theoretically, have gone dead. Even today, a mine is picked up, or run into with disastrous results, every once in a while. It is a risk worth insuring against.

Absolute and Constructive Total Loss

THE distinction between these two classes of losses would appear to be sufficiently self-evident, and yet confusion sometimes remains in the minds of the assured. Abandonment is a privilege of the assured, not an obligation. If he does not wish to do so, he cannot be compelled to abandon his property. When a vessel has been destroyed by fire or the sea or any other peril insured against there is an absolute total loss. Charred fragments may remain, or the ship's equipment may have survived, but the subject of the insurance has ceased to exist, and the underwriter, on proof of the loss and of the assured's insurable interest, must pay the face of the policy upon the production of that document; thereafter he is entitled to realize what he may out of the ruins. Should a ship sink in water too deep for salvage operations, or should she be captured by a belligerent in time of war and be condemned by a prize court, or where, owing to the loss of the vessel, the surviving cargo becomes short of destination and so located as to make forwarding impossible, then the thing insured, or a part of it may still exist but it is either definitely removed out of the possession of its owner and he is without chance of recovering it, or, while the goods may exist, the commercial adventure has been completely destroyed. If the cause of the loss was covered by the policy, then the underwriter must pay as for an absolute total loss.

Constructive total loss arises where the destruction of the property or the commercial adventure is not actual but probable. The ship may be fast on the rocks or on shore and her destruction appear highly probable; she may have sunk in fairly shallow water so that there is a possibility but not a certainty of floating her; she may have been captured by a belligerent, but a chance of restoration may remain, either by recapture or because the prize court finds her detention to have been invalid; or goods may have been saved from a wrecked vessel and be lying at a point where the possibility of their being conveyed to destination remains problematical —in all such instances the cases are of potential total loss. The assured then has the option of abandoning to his underwriters, if the cause of loss is covered by the insurance, he may serve such notice and claim as for a constructive total loss. The notice may be verbal or in writing, and must be given at once, or the right to abandon passes.

Mariners' Insurance Law for Japan

THE next session of the Japanese Diet is to have submitted to it by the Japanese Department of Communications a mariners' insurance law. Private companies have, in the past, looked after this interest, and there has been no national legislation on the subject. But this method has been found to be unsatisfactory because lacking in unity; furthermore, there are a number of shipowners over there who make no provision for insurance. With the recent establishment of a Social Board all business affecting laborers' insurance was transferred from the Department to the Board. After consultations between these two bodies the decision was reached to introduce the new measure at the Diet's next session.

Fruit Damage by Delay

THE United States Circuit Court of Appeals, Fourth Circuit, has recently held that where through negligent stranding a ship chartered for carriage of fruit was late in arriving at loading ports, with the result that fruit awaiting shipment deteriorated, but such as was thought fit was loaded, the ship can be held liable for the loss through further deterioration on the voyage. See 284 Fed. Rep. 1. In this instance the cargo was bananas. The custom is to cut the fruit forty-eight hours in advance of the arrival of the ship, but because the vessel was delayed four days in arriving a claim for $23,533.85 was made. The ship was late because she had stranded in consequence of gross negligence on the part of her navigators.

General Average at Destination

ONE of the propositions that is in for a heated debate when the International Chamber of Commerce meets at Rome on March 18-24 is as to whether general average settlements should take place at the port of destination instead of at the port of embarkation. American marine underwriters are a unit in opposing this eleventh-hour proposal. Indeed, they had no idea that such a subject was to come up, until the tentative program of the meeting was distributed. The Board of Underwriters of New York has unanimously disapproved the idea and has appointed a special committee to bring their views to the attention of the American delegates. They feel that as the parties most interested they should have been consulted in advance. Their opposition is based upon the ground that most ports of destination are without competent adjusters and, further, are not likely to have proper established laws and customs as respects general average.

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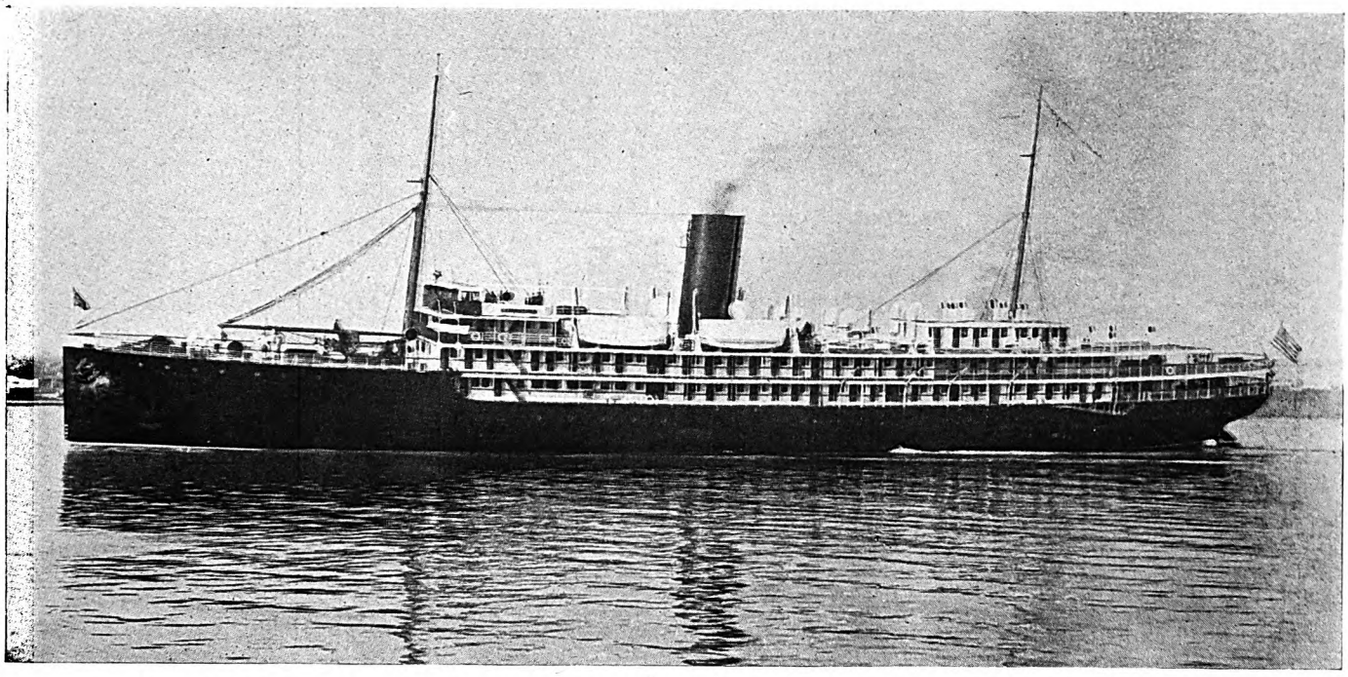

Steamship Haleakala, Built by Sun Shipbuilding Company for Inter-Island Steam Navigation Company, Ltd.

Express Passenger and Freight Steamship Haleakala

Particularly Adapted to Tourist Trade Having Special Facilities for Handling Automobiles and Carrying Riding Horses

DESIGNED for tropical service between Honolulu and Hilo, the express passenger steamship *Haleakala,* recently completed at the Sun Shipbuilding Company, Chester, Pa., under the direction of Captain L. Curtis, for the Inter-Island Steam Navigation Company, Ltd., has many interesting features. The vessel is particularly adapted to the touriest trade. Every stateroom opens directly onto an open deck, assuring plenty of fresh air which is essential for comfort in a tropical climate. As the vessel will operate entirely in the tropics no steam heating system will be fitted but temporary provision for electric heaters in the crew's quarters have been provided. Another feature that will be appreciated by tourists is the 'tween-deck space which is specially designed for carrying automobiles.

The vessel has been built to the highest class of the American Bureau of Shipping. She has a speed of 17½ knots or approximately that of such Atlantic liners as the *George Washington, America* and *Caronia.* The hull is subdivided by seven transverse watertight bulkheads all extending to the second deck except the collision bulkhead which extends to the upper deck. She is equipped with eight lifeboats, each having a capacity of fifty persons and surf boats, all of which are operated by Steward mechanical davits.

General Description

The *Haleakala* is a single screw steel steamship of the flush deck type, with raised forecastle. She is built on the transverse framing system and has a straight stem slightly raked forward. Her bows are flared and her stern is elliptical. The double bottom extends the entire length of the vessel and she has two complete hull decks and two superstructure decks.

There are two steel pole masts with wood pole topmasts. Each mast is built in two strakes with lap seams and strapped butts. Two steel cargo booms of 5-ton capacity, having sufficient length to land loads 12 feet clear of the ship's side with derrick at about 45 degrees, are fitted on the foremast.

The Boat Deck

The deck houses on the boat deck are of wood. In the forward deck house on this deck are located the pilot house, wireless room and officers' quarters. On top of the pilot house is the flying bridge, the forward end and wings of which are entirely enclosed and fitted with windows. A standard compass, steering wheel, telegraph and telephones are installed on this bridge.

The usual standard navigating instruments and steering apparatus are located in the pilot house but, in addition to this, it will be noted from the plans that a chart table is installed in this room instead of in a separate chart room. The wireless room is made sound proof by hair felt fitted between the outer and inner sheathing. The after deck house is entirely devoted to passenger accommodations.

Bridge Deck

The forward portion of this deck or forecastle is arranged for handling the anchors, mooring lines and the cargo. The deck houses are of wood. It will be noticed that all staterooms are outside rooms and that all of their doors open directly on to the deck. These doors, which are particularly wide, all open forward and are fitted with stops and springs to prevent shocks. Windows in all staterooms and officers' quarters are of the balanced drop type with inside slatted blinds. The writing room forward is furnished in Colonial style and the smoking room aft is paneled in oak.

Upper Deck

The crew's space is located at the extreme forward end of this deck, thirty seamen being berthed in one room and the

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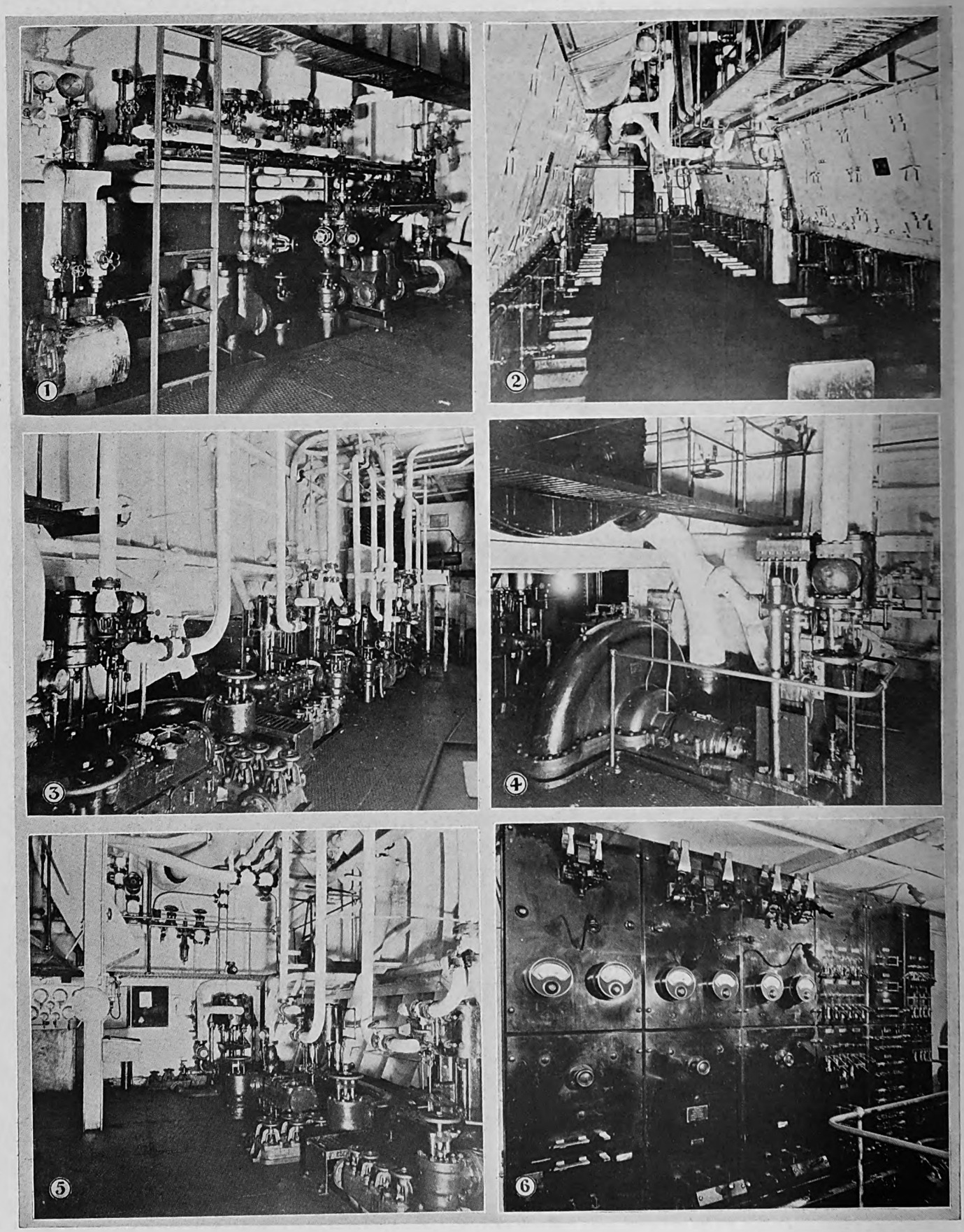

S. S. *Haleakala*: Interior Views of Engine and Boiler Rooms. (1) Fuel Oil Burning System. (2) Boiler Room. (3) Engine Room Auxiliaries. (4) Circulating Engine and Pumps. (5) Engine Room Auxiliaries. (6) Switch Board.

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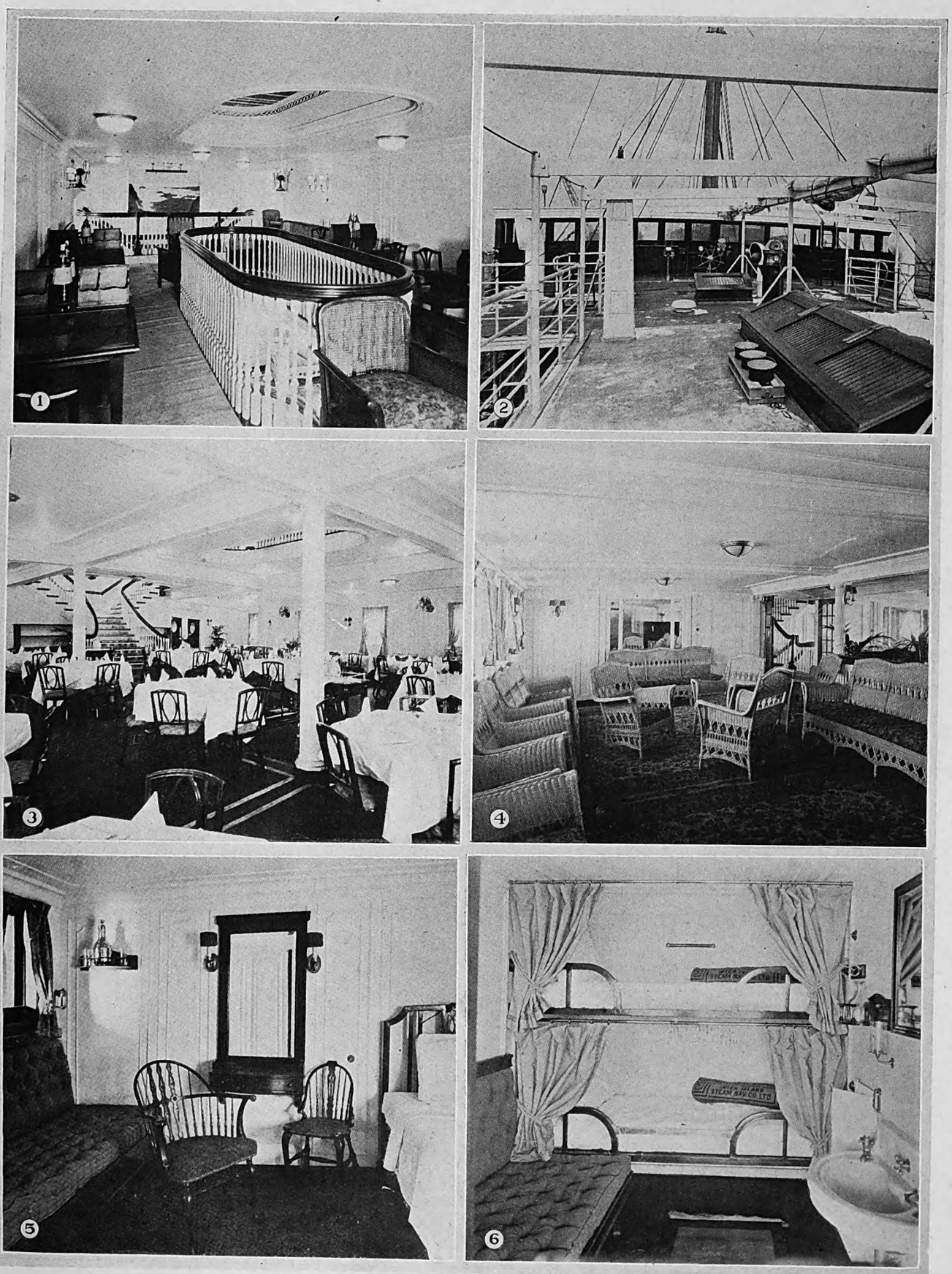

S. S. *Haleakala*: Interior Views of First Class Accommodations and Flying Bridge. (1) Writing Room. (2) Flying Bridge. (3) Dining Saloon. (4) Social Hall. (5) Typical Suite Room. (6) Typical Stateroom

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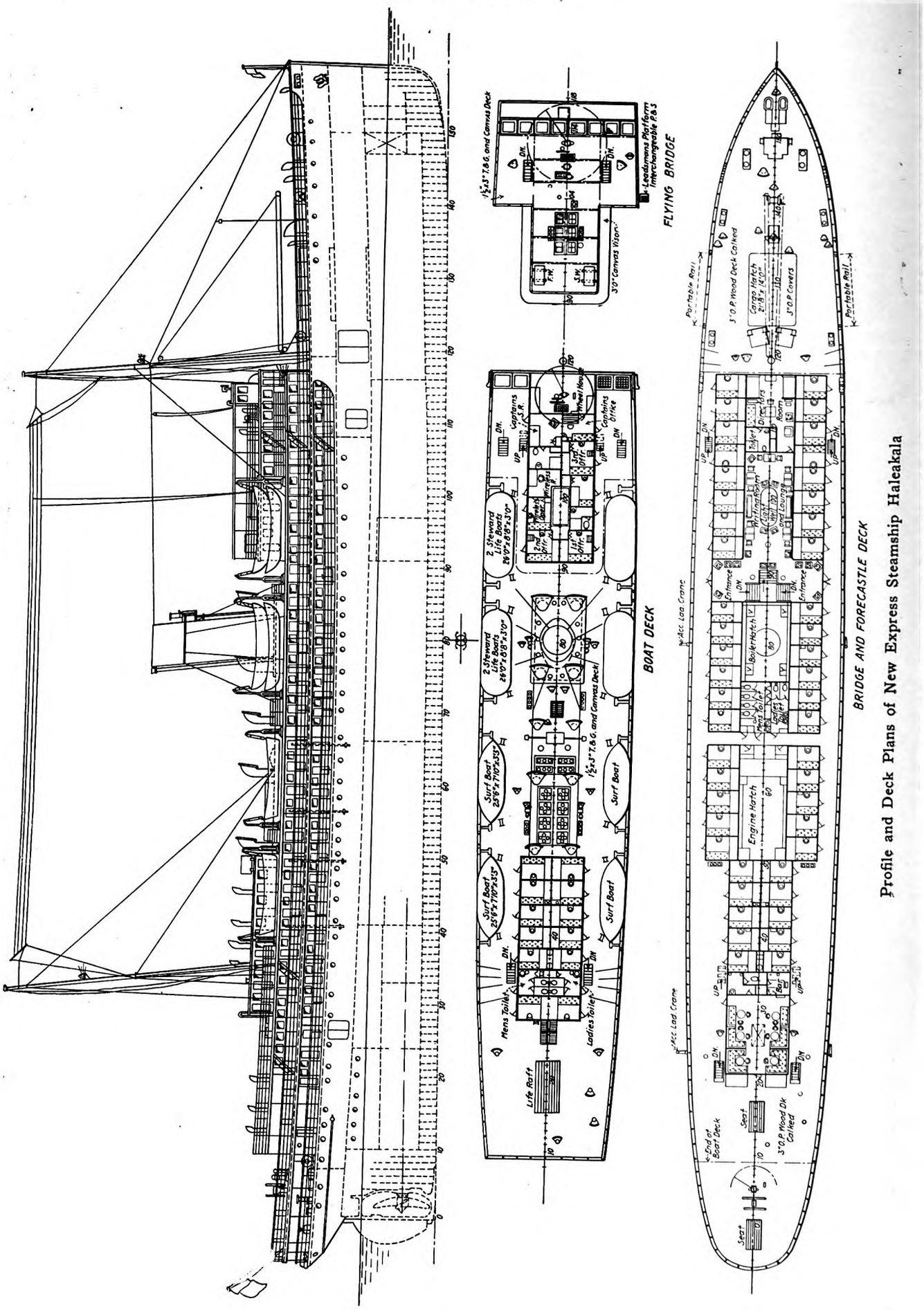

Profile and Deck Plans of New Express Steamship Haleakala

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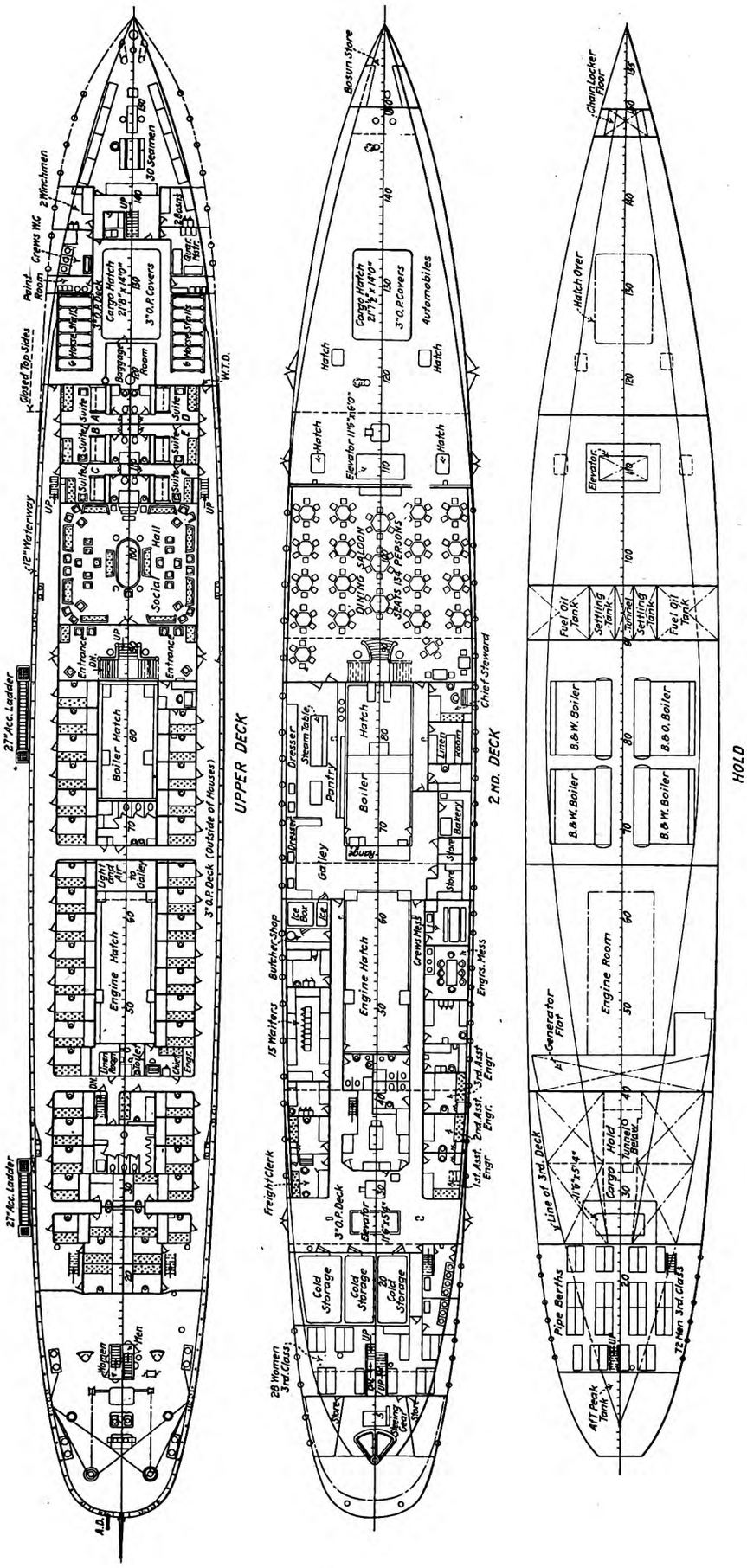

Deck Plan of New Express Steamship Haleakala

petty officers in separate staterooms. Between the crew's space and the passenger accommodations and in way of the main cargo hatch, stalls have been fitted for twelve horses. A baggage room has also been constructed just aft of the hatch and extending to a bulkhead which forms the after end of the inclosed portion of this deck.

The passenger accommodations on this deck are inclosed in steel deck houses, the sides of which are located far enough inboard from the bulwarks to provide plenty of promenading space.

SUITES DE LUXE

There are six suites with separate toilets and showers on this deck all decorated in different designs. A Pullman berth is fitted in each suite to accommodate a third person when desired. The remainder of the deck is occupied by first class accommodations, including a large social hall.

THE SECOND DECK

The forward end of this deck will be used for cargo space and for stowing automobiles. Cargo doors are fitted in the sides of the ship through which cars may be driven or merchandise trucked on or off. A feature here is a freight elevator on which several truck loads of cargo may be lowered to the hold at the same time and then wheeled to their stowage location. It will be noted from the plans that the only means of access for the horses on the deck above is through the cargo hatch, which means that they will have to be picked up by slings or driven up a ramp.

The first class dining saloon located just forward of the boiler hatch on this deck will accommodate 134 passengers at one sitting. It is finished in Colonial design and with tables seating six persons.

Aft of the dining room and along both sides of the engine and boiler casings are located the galley, pantry, bakery, linen room, engineer officers' quarters and crew's messroom. The cold storage rooms and steerage accommodations for women are located aft.

VENTILATION

Particular care has been taken to provide ample ventilation. In addition to the natural ventilation through cowls, fans are installed as follows:

A 400-cubic foot suction fan located in a locker on the upper deck drawing from the suite toilets and discharging to the atmosphere through a ventilator on the flying bridge.

Two 1,500-cubic foot fans located in the social hall entrance, taking air directly from the atmosphere and dis-

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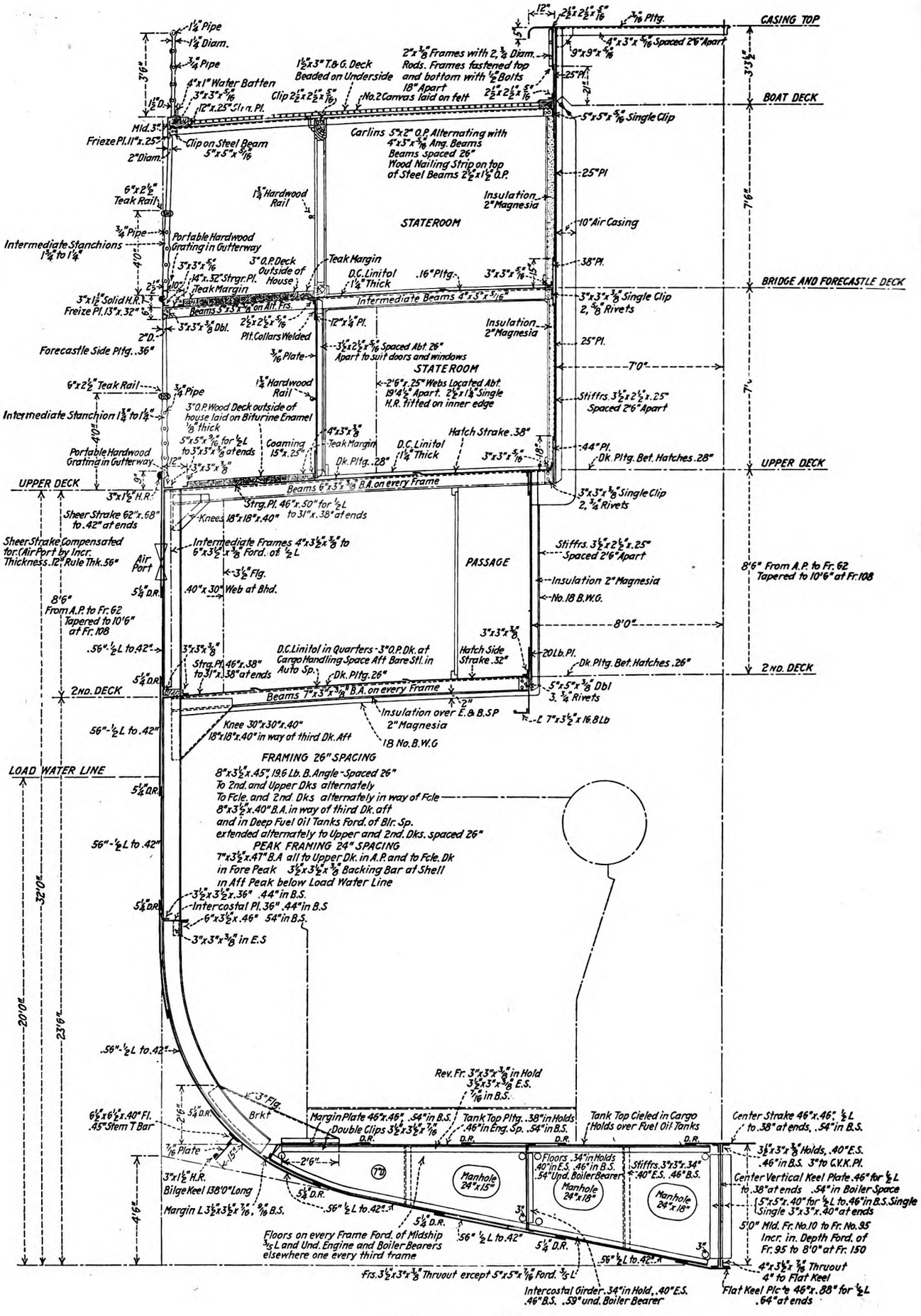
CASING TOP
BOAT DECK
BRIDGE AND FORECASTLE DECK
UPPER DECK
2ND. DECK
LOAD WATER LINE
STATEROOM
PASSAGE
Carlins 5"x2" O.P. Alternating with 4"x3"x5/16 Ang. Beams Beams spaced 26" Wood Nailing Strip on top of Steel Beams 2½"x1½" O.P.
Insulation 2" Magnesia
Intermediate Beams 4"x3"x5/16
Beams 6"x3"x5/16 B.A. on every Frame
Beams 7"x3½"x5/16 B.A. on every Frame
FRAMING 26" SPACING
8"x3½"x.45", 19.6 Lb. B. Angle - Spaced 26" To 2nd. and Upper Dks alternately To Fcle. and 2nd Dks alternately in way of Fcle
8"x3½"x.40" B.A. in way of third Dk. aft and in Deep Fuel Oil Tanks Ford. of Blr. Sp. extended alternately to Upper and 2nd. Dks. spaced 26"
PEAK FRAMING 24" SPACING
7"x3½"x.47" B.A all to Upper Dk. in A.P. and to Fcle. Dk in Fore Peak 3½"x3½"x⅜" Backing Bar at Shell in Aft Peak below Load Water Line
Floors on every Frame Ford. of Midship ⅗ L and Und. Engine and Boiler Bearers elsewhere one every third frame
Frs. 3½"x3"x⅜" Thruout except 5"x5"x7/16 Ford. ⅗ L
Intercostal Girder .34" in Hold, .40" E.S. .46" B.S. .59" und. Boiler Bearer
Flat Keel Plate 46"x.88" for ½ L .64" at ends
Center Vertical Keel Plate .46" for ½ L to .36" at ends .54" in Boiler Space
5'0" Mld. Fr. No. 10 to Fr. No. 95 Incr. in. Depth Ford. of Fr. 95 to 8'0" at Fr. 150
Tank Top Ceiled in Cargo Holds over Fuel Oil Tanks
Manhole 24"x15"
Manhole 24"x18"
Manhole 24"x16"

Midship Section

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Express Passenger and Freight Steamship Haleakala

General Information

Service: Passenger and Freight.

Builder: Sun Shipbuilding Company, Chester, Pa.

Owner's Representatives: Pillsbury and Curtis, Naval Architects, San Francisco, Cal.

Owner: Inter-Island Steam Navigation Co., Honolulu, T. H.

Characteristics

Length, overall	360′ 6½″
Length, B. P.	345′ 0″
Breadth, molded	46′ 0″
Depth, molded	32′ 0″
Draft, loaded	20′ 0″
Draft, light	16′ 4¾″
Block coefficient	0.535
Midship section coefficient	0.862
Longitudinal coefficient	0.621
Speed, loaded, knots	16.5
Cruising radius, nautical miles	6,600
Framing	Transverse
Class	A. B. S.

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull	
**Weight Propelling Machinery	
Deadweight Capacity	1209 T.
Displacement	4,885 T.

(In tons of 100 cubic feet)

Gross register	3,679
Net register	1,546

*Weight of Hull includes Hull Proper, Hull Fittings, Equipment and Outfit.

**Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, and Machinery Space Auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez		
Panama	4,296	2,158

Equipment

Anchors—2 Bower 5,600 lbs.
1 Bower 4,760 lbs.
1 Stream 2,100 lbs.
1 Kedge 840 lbs.

Chain—170 Fathom 2″ stud.

Rudder

Area	105.0 sq. ft.
Dia. Stock	12″
C. Press. abaft C. L. pintles	2.95 ft.

Complement

Deck officers	4
Deck crew	37
Engineer officers	4
Engineer crew	12
Purser's and steward's department	24
Total officers and crew	81
First-class passengers	334
Second-class passengers	100
Third-class passengers	
Total passengers	434
Total complement	515

Handling Equipment

	No.	Type	Capacity	Length
Masts	2	Steel	....	....
Derrick posts	....	....	....	....
Booms	2	Steel	5 tons	....
Discharging Capacity				

Deck Machinery

(Number, Size, Type)

Stearing Gear	One 9 x 9 steam
Windlass—	One 9 x 10 steam
Capstans	
Winches—	Four 7 x 10 steam
	One 8¼ x 10 steam

Life Saving Equipment

Lifeboats	No.	Type	Length
	8	Neward	26 ft.
	4	Surf boats	26 ft.

Propelling Machinery

Boilers

Number	Four
Type	Watertube
Length	
Width or Diameter	
Furnaces	24
Fuel	Oil
Draft	Forced
Total heating surface, square feet	19,200
Total grate surface or furnace volume	
Superheat, degrees F.	
Working pressure, lbs. per sq. in.	220
Normal fuel consumption:	
Per day, tons	
Per horsepower hour, pounds	
Normal steam production:	
Per hour per pound of fuel	lbs.
Total per hour	lbs.

Engines

Number	One
Type	4-Cyl. Triple
Size	30 x 52 x 65 x 65 x 54 stroke
Horsepower	5,000

Propellers

Number	One
Type	4 Blades
Weight	
Diameter	17′ 3″
Pitch	24′ 9″
R. P. M.	80
Projected area	
Developed area	

Auxiliary Machinery

(Number, Size, Type)

Machinery Space

Condensers	One
Evaporators, Distiller, Filters	None
Feed water heater	Griscom-Russell
Fuel oil heaters	4-Coen

Pumps—16″ Circ.
1—14 x 35 x 21 Air Pump.
2—15½ x 11½ x 24 Feed Pumps.
1—12 x 8½ x 12 Fire & Gen. Serv. Pump.
1—10 x 12 x 10 Ballast Pump.
2—7½ x 7 x 10 Bilge Pumps.
1—7½ x 7 x 10 Fresh Water Pump.
1—7½ x 9 x 10 Sanitary Pump.
2—10 x 4½ x 10 Fuel Oil Serv. Pumps.
1—7½ x 10¼ x 10 Transfer.
2—Hand Fire Pump.

Refrigerating Machinery

1—3-ton

Electric Equipment

Generators.....2—60 k.w., 1—20 k.w.
Radio....I. K. W. Radio Corp. of America
Emergency .....Storage Batteries

Holds

No.	Length	Hatches
1	64	1
2	42	1

Capacities

Cargo Space

Compartment	Cu. Ft.
Hold No. 1	22,351
Hold No. 2	24,084
Tw'n d'k—Fwd	26,507
Tw'n d'k—Aft	9,463
Fcsl. tw'n dk	6,700

Refrigerated Space

Compartment	Cu. Ft.
No. 1	723
No. 2	825
No. 3	935

Bunkers

Compartment	Cu. Ft.	*Bbls.	*Tons
Fwd.	7,884		
Aft	7,159		

Tanks

Compartment	Cu. Ft.	Tons F. W.	Tons S. W.
No. 1—1-B	2,168	....	62.0
No. 2—1-B	4,107	....	117.0
No. 3—1-B	....	....	98.0
No. 4—	....	208.0	....
No. 5—	....	113.0	....
No. 6—	....	....	40.0
Total		321.0	317.0

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charging through ducts to each side of the dining saloon.

Two 1,300-cubic foot fans located on the upper deck level in the galley trunk taking air directly from the passageway on the upper deck and discharging through ducts to all rooms between frames 62 and 86 on the second deck.

Two 1,300-cubic foot fans located in the chief engineer's toilet and linen room on the upper deck, taking air direct from the passageway and discharging through ducts to all toilets and quarters between frames 29 and 62 on the second deck.

Two 1,300-cubic foot fans located on the upper deck entrance taking air direct from the atmosphere and discharging through ducts to the third class quarters.

Four 1,000-cubic foot fans will circulate air through a 10-inch air passage or cofferdam fitted around the engine and boiler casings in the way of the quarters. An individual 10-inch electric fan is fitted in each first class stateroom and special fans in the public rooms.

Propelling Machinery

The propelling machinery consists of one four cylinder triple expansion engine to be supplied with steam at 210 pounds per square inch at the throttle.

Boilers

The vessel has four Babcock & Wilcox marine watertube boilers, each having 4,809 square feet of heating surface, or a total for the four boilers of 19,236 square feet, arranged for oil fuel. The boilers are thirty sections wide, each section having six and one-half clusters of four 2-inch tubes with one 4-inch tube over the furnace, the tubes being 10 feet long. The boiler capacity has been so designed that three boilers will at all times maintain power with main engines and auxiliaries working maximum capacity, leaving one boiler for reserve, as required by the owners.

Each boiler is equipped with six Babcock & Wilcox mechanical atomizing oil burners, Cuyama type, arranged to operate under forced draft. Individual blowers situated at the rear of the boilers deliver the necessary air through ducts running under the boilers to the duct surrounding the burners formed by the outer and inner front plates of the boilers.

Oil and Ballast System

The double bottom compartments, except under the engine and fire rooms and fore-and-aft peak tanks, are fitted for both oil and water ballast. The double bottom compartment under the engine room is for fresh water only and that under the fire room for oil only. The forepeak tank is fitted for water ballast only and the after peak tank for fresh water and ballast.

The oil system manifolds are located in the machinery space and are connected to the fuel oil transfer pump. There is a port manifold and a starboard manifold with separate suction pipes to each compartment and the piping is so arranged that oil can be transferred from a forward port tank to a starboard forward tank or vice versa for trimming purposes.

The ballast system consists of a starboard and a port manifold connected to ballast pump. Separate suction pipes run to each compartment and the piping is so arranged that ballast can be pumped to port or starboard and also to peak tanks.

Express Steamers Ordered for Eastern Steamship Line

Contract for Two Oil Burning, Turbine Driven, 17-Knot Passenger Steamers Awarded to Bethlehem Shipbuilding Corporation, Ltd.

A CONTRACT for the construction of two 17-knot, turbine driven, passenger steamers for night service on the Boston-New York run, operating through the Cape Cod Canal, was awarded last month to the Sparrows Point yard of the Bethlehem Shipbuilding Corporation, Ltd., by the Eastern Steamship Line, of which Calvin Austin, India Wharf, Boston, Mass., is president. The vessels, which were designed by Theodore Ferris, naval architect and marine engineer, 30 Church street, New York, will cost approximately $3,650,000. The first vessel will be delivered in April and the second in May, 1924.

The principal dimensions of the vessels are as follows:

Principal Dimensions

Length over guards	402 feet
Length over hull	401 feet 1 inch
Length on 15-foot waterline	396 feet 4 inches
Length between perpendiculars	385 feet
Beam over guards	72 feet 6 inches
Beam over hull	71 feet 2 inches
Beam at 16-foot 6-inch waterline	56 feet 6 inches
Depth molded to main deck at side	23 feet 9 inches
Designed load draft	16 feet 6 inches

At the 16-foot 6-inch molded draft in sea water the vessels will have a displacement of 5,300 tons. The block coefficient on the displacement length of 395 feet is 0.5035.

Propulsion of the vessels will be by twin screws, driven by geared turbines. With the propellers turning at 120 revolutions per minute the designed shaft horsepower of the propelling machinery will total 6,400; at a 17-knot service speed on a 16-foot 6-inch draft the estimated effective horsepower is 2,580 and at a 19-knot maximum speed on the same draft the estimated effective horsepower is 3,980.

It is estimated that the shaft horsepower required for a service speed of about 16½ knots will be about 4,500 and the fuel consumption for all purposes 1.2 pounds per shaft horsepower per hour. The fuel requirements will be as follows: 15 hour run, one way, 36 tons of oil; 15 hour run, round trip, 72 tons of oil; port use, 5 tons of oil; total fuel oil, round trip, 77 tons of oil, or about 530 barrels. The total fuel oil capacity in the deep tanks is 270 tons, which is sufficient for about three round trips.

The tonnage of the vessel is approximately: gross, 5,100; net, 2,850.

While the service speed of these steamers as night boats between New York and Boston operating through the Cape Cod Canal will be nominally 17 knots, because of delays and detentions on this route, such as fog, congested waterway through the canal, etc., and the possibility at times of operating outside Cape Cod, the steamers are designed to have a possible speed under maximum power, oil burning, of 19 knots.

Weights

The carrying capacity in service figures out as follows:

Equipped weight, water in boilers, condenser and piping	4,200 tons
Margin weight for equipped ship	250 tons
Fuel oil (bunker weight)	120 tons
Boiler feed water	70 tons

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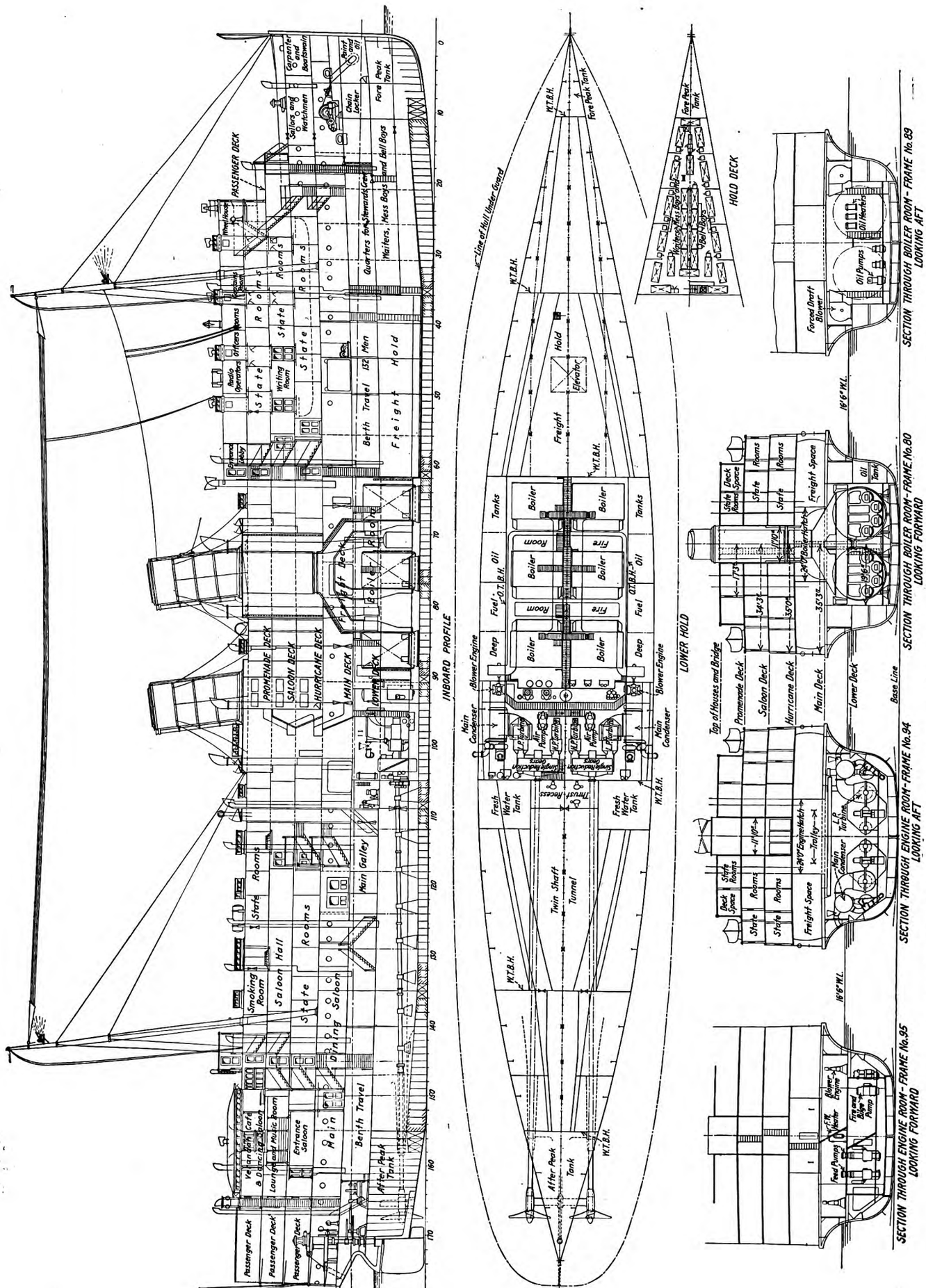

Inboard Profile, Hold Plan and Sections of New Express Steamers for Eastern Steamship Line

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Culinary water	100 tons
Passengers and their effects	60 tons
Baggage, automobiles, etc.	20 tons
Provisions and stores	20 tons
Crew and their effects	10 tons
Cargo freight	400 tons
Trimming water	50 tons
Total	5,300 tons

The displacement on a 16-foot 6-inch draft will be 5,300 tons.

Passengers and Rooms

The vessels are designed to carry but one grade of passengers in rooms while separate open spaces will be provided for berth travel of men and women. The total number of regular passenger rooms is 267; number of passengers with two in each room, 534; de luxe rooms with adjoining baths, 14; capacity, with two persons in each, 28; special rooms with adjoining toilet, 64; capacity, with two persons in each, 128. Total number of rooms, 345; total passengers in rooms, 690.

In addition to the stateroom accommodations provision will be made for berth travel for 160 men and 50 women, making the total number of berth travel passengers 210 and the total number of passengers 900. The crew will number, deck department, 46; engine department, 27; steward's department, 95; total crew, 168; total persons on board, 1,068.

These steamers will be equipped with lifeboats in davits with collapsible boats stowed underneath, life rafts not being considered desirable. The lifeboat equipment as designed will consist of four metallic lifeboats, 24 feet by 7 feet by 3 feet with a capacity of 30 persons each, giving a total capacity of 120; 12 metallic lifeboats, 26 feet by 7 feet by 9 feet by 3 feet 4½ inches with a capacity of 40 persons each, providing for a total of 480 persons; 12 collapsible lifeboats, 24 feet by 7 feet by 2 feet with a capacity of 40 persons each, providing for a total of 480 persons. This equipment provides a total boat capacity of 1,080 persons.

General Arrangement

The vessels will be twin screw steel sponson sided type passenger steamers with freight space on the main deck and one freight hold. The hulls will be constructed with transverse framing with web frames in conjunction with side stringers. A complete double bottom will extend fore and aft with tanks fitted for water ballast for trimming purposes, fresh water for ship's use and for boiler feed use. There will also be built-in tanks for culinary water and built-in deep fuel oil tanks. The fore and after peaks will be fitted for salt water trimming tanks.

The hull will be divided transversely by seven watertight bulkheads carried up to the main deck, stepped as required and fitted with watertight flats as shown on the plans. There will be one common shaft tunnel with port and starboard tunnel recess.

In view of their service through the Cape Cod Canal, and, due to the possibility of their taking a bad shear and fetching up with their bilges on the banks of the canal, the steamers will be provided with bilge protection through the midship portion of the hull made up of deep fuel tanks abreast the boilers, dry tanks in way of the engine room and cargo double bottom tanks up the sides in Nos. 2 and 3 holds with a longitudinal bulkhead port and starboard in way of the shaft tunnel.

The vessels will be fitted with two light steel masts for wireless and signalling apparatus, one main double smokestack and one ventilating stack, a duplicate of the main smokestack in appearance. The stem will be straight with a slight rake forward. At the saloon deck aft of the stem for about 48 feet light steel bulwarks will be fitted on each side. The stern will be of special type, elliptical in shape around the guard line with waterline extension over the rudder. The vessels will be fitted with steel guards.

The general arrangement of the accommodations is shown on the plans. The vessels will be equipped with electric light and steam heat throughout.

There will be three freight doors on each side off of the main deck and a freight hatch forward through the main and lower decks to serve the forward freight hold. This hatch will be equipped with an elevator of 4,000 pounds lifting capacity running from the tank top to the main deck level operated by an electric winch on the main deck. An elevator of 1,000 pounds lifting capacity will be installed on the port side of the after end of the freight deck for handling stores down to the galley and store room.

At the after end of the engine room on the level of the lower deck will be the ice machine room on the port side and the dynamo room on the starboard side.

Propelling Machinery

The propelling machinery will consist of two Parsons single reduction gear steam turbines and six cylindrical return tubular Scotch boilers, 16 feet 4 inches inside diameter by 11 feet 8 inches long over top heads, built for a working pressure of 200 pounds per square inch, and one donkey boiler vertical wet uptake type 6 feet inside diameter by about 101 inches high built for 150 pounds per square inch working pressure.

The twin screw turbine propelling machinery will be built from designs as furnished by the Parsons Steam Turbine Company, Ltd., of Wallsend-on-Tyne, in which each set will consist of one high pressure and one low pressure turbine in series each driving a separate pinion through single reduction gearing. Astern turbines of the impulse type capable of developing 60 percent of full ahead power will be incorporated in each low pressure ahead turbine. The revolutions of turbines at full power ahead will be high pressure turbine, 1,920 revolutions per minute; low pressure turbine, 1,920 revolutions per minute. At these revolutions the turbines will develop a total of not less than 6,400 shaft horsepower. The speed of the propellers will be 120 revolutions per minute.

The six boilers will be arranged for two fire rooms with grates fore and aft and will be fitted with the Howden system of heated forced draft with heater tubes for raising the temperature of the air before it enters the furnace. The boilers will be connected to one smokestack.

The propellers will be solid right and left hand propellers of manganese bronze three bladed about 13 feet 9 inches diameter.

There will be two main surface condensers each containing 4,800 square feet of cooling surface.

Pumps

The pumps will be of the Blake-Worthington type of the following dimensions:

Two main circulating pumps about 14 inches diameter.
Two main twin beam air pumps, 12 inches by 28 inches by 18 inches.
Two vertical simplex feed pumps, 18½ inches by 13½ inches by 24 inches.
One vertical duplex ballast pump, 10 inches by 12 inches by 12 inches.
One vertical duplex fire and bilge pump, 12 inches by 8½ inches by 12 inches.
One vertical duplex sanitary pump, 10 inches by 12 inches by 12 inches.
One vertical duplex fresh water pump, 6 inches by 4 inches by 6 inches.
One vertical duplex ice machine circulating pump, 6 inches by 4 inches by 6 inches.
One vertical duplex scuttle butt circulating pump, 6 inches by 4 inches by 6 inches.
Two vertical duplex brine circulating pumps, 7½ inches by 5 inches by 6 inches.
One vertical simplex donkey boiler feed pump, 4½ inches by 2¾ inches by 6 inches.
Two vertical duplex fuel oil service pumps, 7½ inches by 5 inches by 6 inches.
One vertical duplex fuel oil transfer pump, 7½ inches by 9 inches by 10 inches.
Three vertical simplex lubricating oil pumps, 8 inches by 10 inches by 12 inches.
One vertical duplex oil cooler circulating pump, 10 inches by 12 inches by 12 inches.
Two Metropolitan double tube injectors size about No. 14½.
One donkey boiler injector Metropolitan double tube type.

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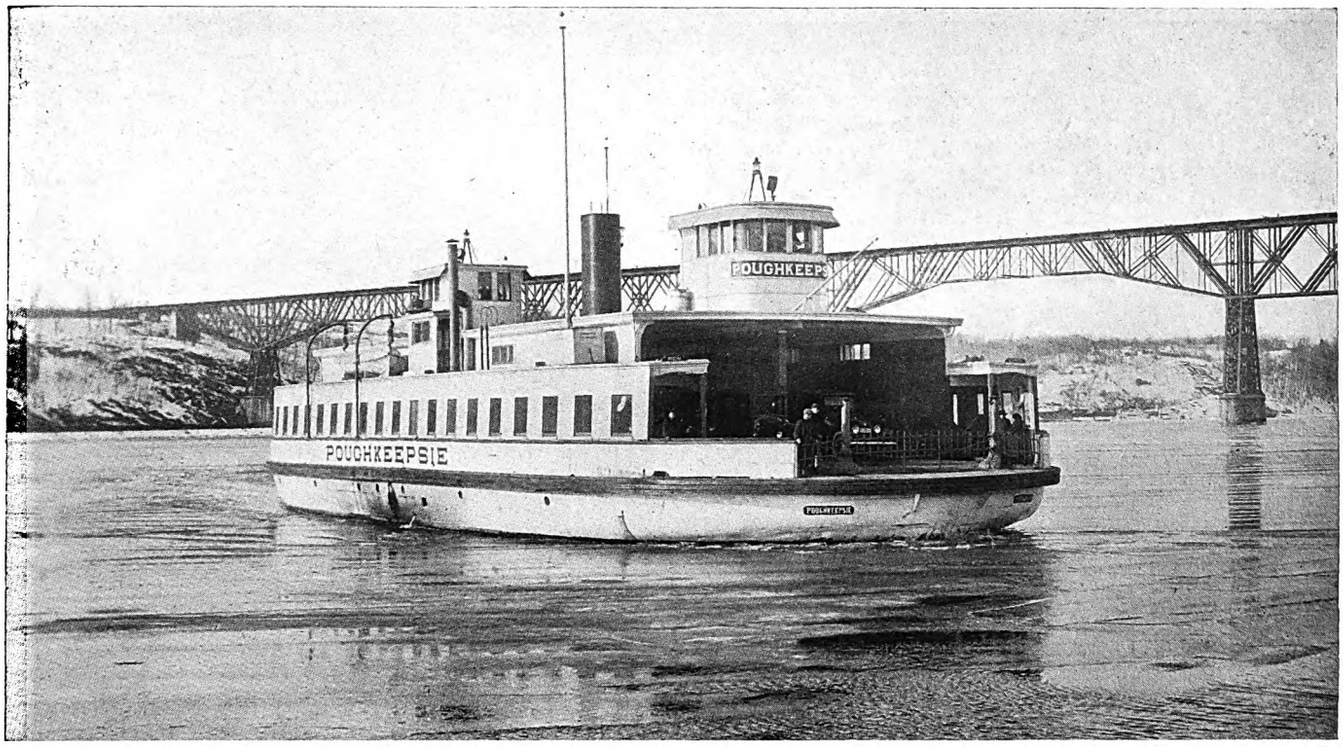

Ferryboat Poughkeepsie, Operated by the Westinghouse-Winton Diesel-Electric System, One of the First Commercial Vessels to Be Operated by Electricity

The Electric Ferryboat Poughkeepsie

Economical Operation Secured by Diesel-Electric-Geared Drive Installed in Hullfin Type of Vessel

By William H. Easton*

THE ferryboat *Poughkeepsie,* which is now in operation between Poughkeepsie and Highland on the Hudson River, is one of the most remarkable craft afloat. She is one of the first commercial vessels to be propelled by electricity; she is the first Diesel electric ferry to be put into operation; she is the only Diesel-electric-geared vessel in existence; she is the first to be constructed with a hullfin; and she has been especially designed to act as an ice-breaker. Because of this unusual combination of unique features, she has attracted a great deal of interest in the shipping world. She was completed in September, 1922, but at first was not able to make her required speed. This difficulty has been overcome, however, and she was recently placed in regular service.

Her propelling machinery is, of course, the most important part of her equipment. This consists of two 125-horsepower Winton Diesel engines, each of which drives a 90-kilowatt Westinghouse generator, which in turn furnish power to two 100-horsepower Westinghouse motors geared to the propellers.

Fuel Consumption Low

There are several reasons why this form of drive was adopted. The most important is its high fuel economy. There is every reason to believe that the *Poughkeepsie* can develop a brake horsepower per hour on less than a half a pound of oil, whereas she would certainly require over a pound of oil to develop the same amount of power, if she had the most efficient form of steam engine. In addition, she has no standby losses whatsoever. Consequently, when sufficient data are accumulated it is fully expected that the daily fuel cost of the *Poughkeepsie* will prove to be about one-third of that required by a steam operated vessel of similar power and hull size.

Another advantage is the compactness of the machinery. It can all be contained within the hull without a superstructure, leaving the main deck perfectly clear and providing room for four lines of automobiles in addition to the passenger cabins on either side. The *Poughkeepsie's* car capacity is therefore practically double what it would be with steam propulsion.

Vessel Controlled from Pilot House

Finally, the pilot has absolute control over the movements of the vessel. By merely moving a small handle located behind the wheel in each pilot house, he can start, stop, reverse, or change the speed of the boat without the loss of an instant's time or the slightest opportunity of having his signal's misunderstood. So quick is this control that the *Poughkeepsie* can be brought from full speed ahead to full speed astern in less than a minute.

To look at the *Poughkeepsie,* she appears to be broad, shoal, and of very light draft. This is not the case, however, for under her visible hull is a second one, known as the

*Westinghouse Electric & Manufacturing Company.

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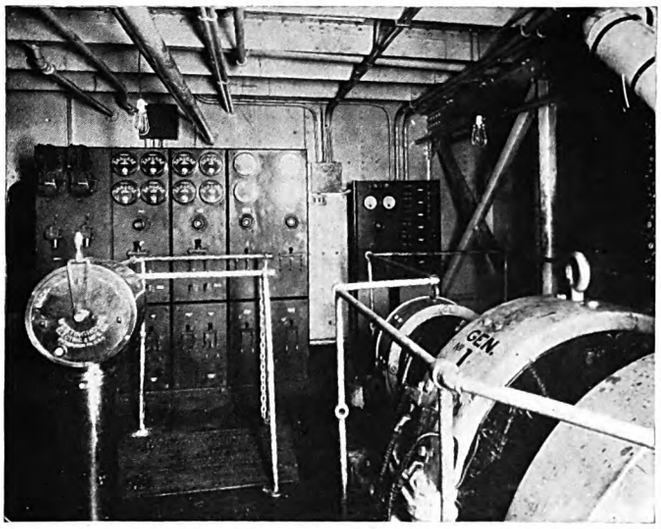


The Poughkeepsie's Main Switchboard, Showing Auxiliary Engine Room Controller

In the Poughkeepsie's Pilot House. The Pilot Controls Every Movement of the Boat by Turning the Handle of the Propeller-Motor Controller Located Behind the Wheel

"hullfin," which is a long and narrow stream-line projection, like an enlarged keel. It contains the propeller motors, gears and shafting, and carries the propellers at its ends. Its chief purpose is to place the propellers under the boat, where they are always immersed in solid water. It also enables the *Poughkeepsie* to act as an ice breaker. Instead of wedging into the ice, as a boat with a standard hull will do, the broad end of the *Poughkeepsie* rides over it, crushes it and then pushes it aside. The position of the propellers on the hullfin prevents them from being injured during the process.

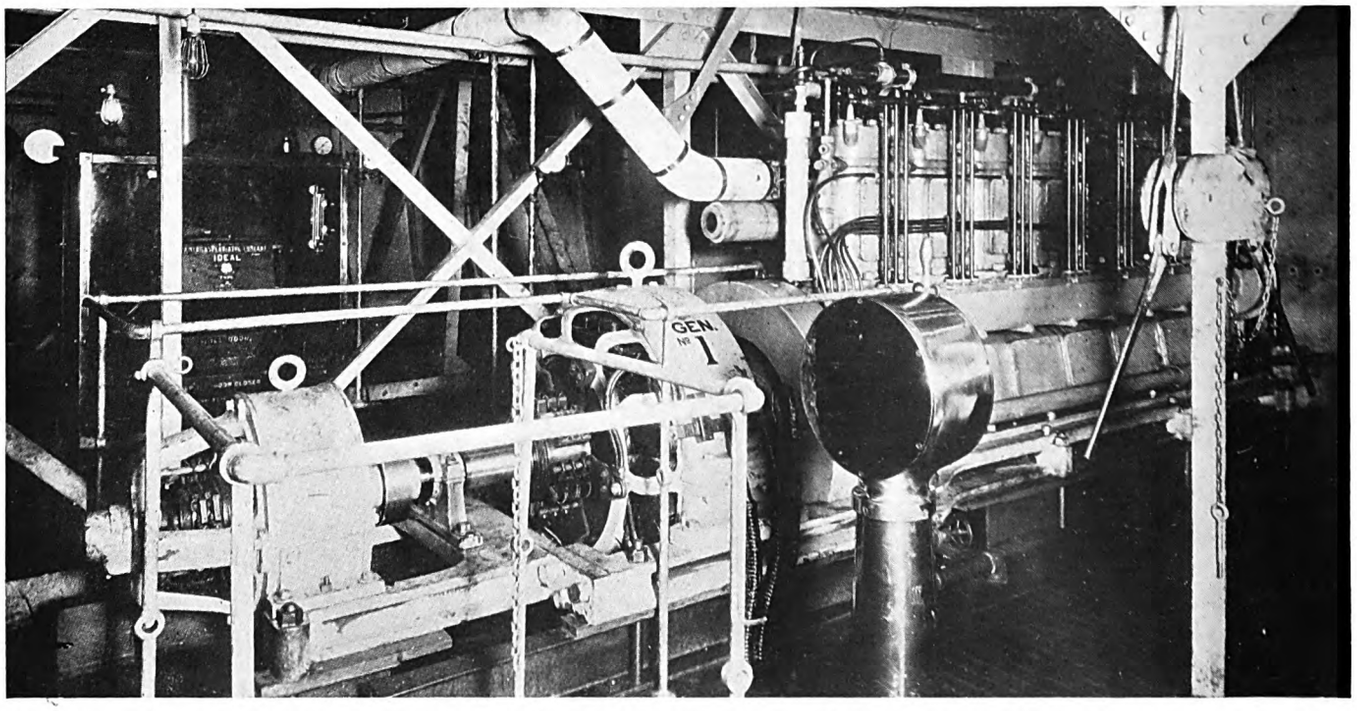
No very heavy ice has been encountered in the river so far this winter, but it is expected that the *Poughkeepsie* can be kept in operation with even the maximum thickness of ice, which sometimes exceeds two feet at this point.

Details of Construction

The *Poughkeepsie* was built in the Mill Basin, Brooklyn, yards of the Atlantic, Gulf & Pacific Company for the Poughkeepsie & Highland Ferry Company. She has a length over guards of 140 feet, beam over guards of 52 feet, total draft of 10 feet, hullfin draft of 6 feet, and a displacement of 400 tons. Her hull is of steel and her superstructure of wood with steel supports, trusses and tie rods. At each end of the hull there is a special system of framing and extra heavy plating designed to provide the resistance necessary for the ice crushing service. The hull itself extends to the fender guards furnishing maximum stability and eliminating the overhanging guards and braces in general use.

Propelling Machinery

The engines are of the Winton model W59 Diesel type, with six 7½ by 11-inch cylinders, and operates at 450 revolutions per minute. The main generators are rated at 90 kilowatts each and supply 250-volt direct current. Two 9-



One of the Poughkeepsie's Two Main Generating Units, Consisting of a 125-Horsepower Winton-Diesel Engine Driving a 90-Kilowatt Westinghouse Generator, with a 9-Kilowatt Westinghouse Exciter

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kilowatt Westinghouse generators, driven from the main engines, furnish excitation for the main generators and motors, as well as power for lighting and other purposes when the vessel is in operation.

For use when the main engines are shut down, there is a 7½-kilowatt gasoline-driven generator. This supplies sufficient power for lights and also for operating a small motor-driven compressor which provides air at 600 pounds pressure for starting the main engines.

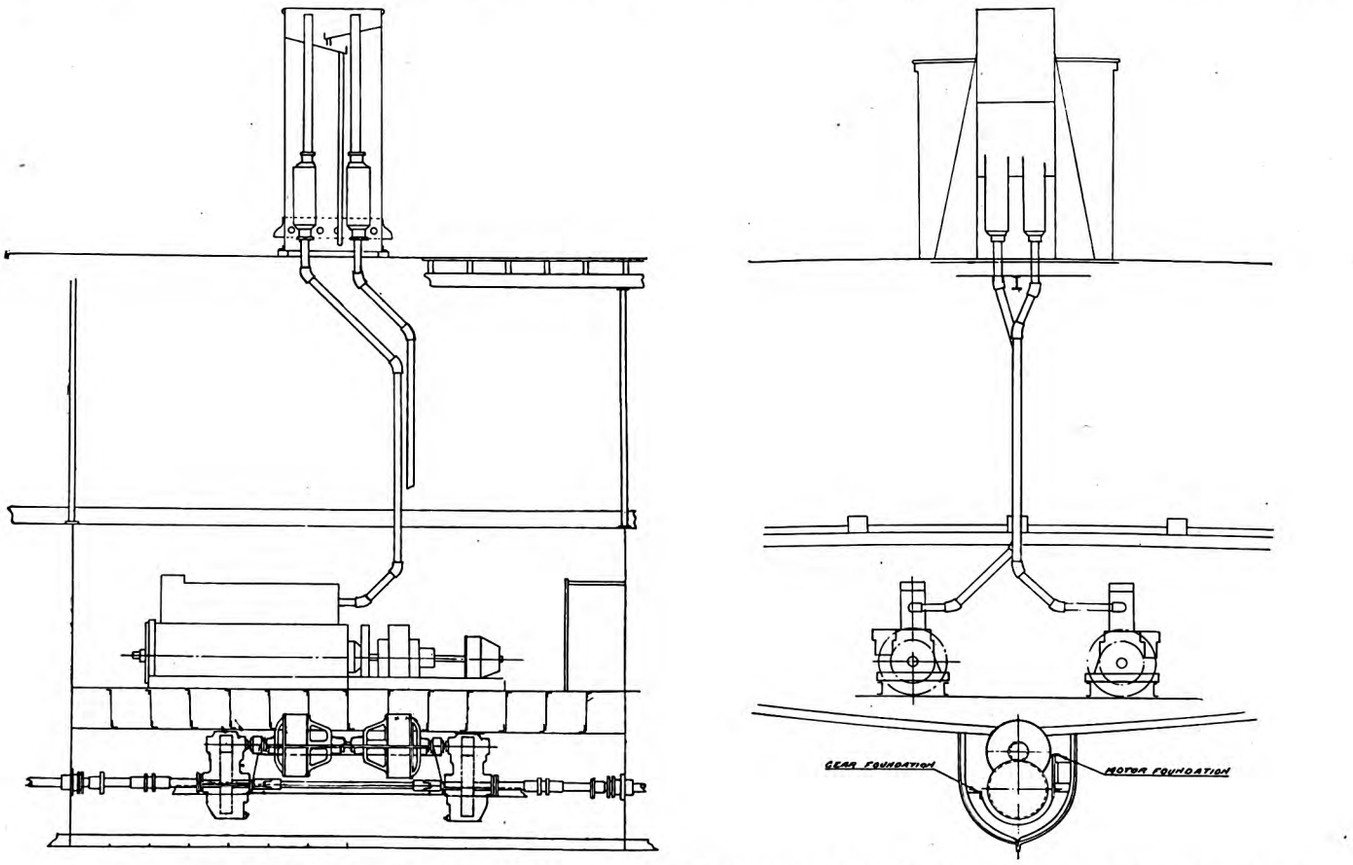
The main engines operate continuously at constant speed in one direction only during the operation of the boat, all speed changes in the boat's movements being made by changing the speed or direction of rotation of the motors. Either or both engines can be used at any time.

A small rheostat, located under the floor of each pilot house and operated by the pilot's controller, controls the motors by varying the voltage and the direction of the main generator field-current supplied by the exciters. The amount of current handled by the rheostat is small, so that the control equipment is very light. In addition to the controllers in the pilot houses, there is a third one in the engine room for emergency purposes. A switch prevents the use of more than one controller at a time. Should the circuit-breakers, which protect the main circuits by opening automatically on overloads, operate and cut off the current to the propeller motors, they are reset by pressing a button located on each controller. All the controlling and switchboard apparatus is of Westinghouse make.

Reduction Gears Installed

As originally designed, the propeller motors, which operate from 600 to 720 revolutions per minute, maximum, were connected directly to the propeller shaft. It was not possible, however, to obtain full speed with the 48 by 26-inch propellers then used. Messrs. Tams & King were retained as consulting engineers to correct this trouble, and at the suggestion of their Mr. A. B. Raymond, herring-bone gears, giving a 3¼ to 1 reduction, were installed between the motors and the propeller shaft, and 60 by 60-inch, semi-steel Kearfott propellers, to operate at about 220 revolutions per minute were substituted for the original ones.

The result of these changes was the gain of about 45 percent in the *Poughkeepsie's* speed, so that she now runs at about 9 miles per hour. Normally both motors and both propellers are operated so as to give ample power and eliminate the drag due to the forward propeller, but either motor or either propeller can be cut out, if desired.



Arrangement of the Pougkeepsie's Two 100-Horsepower Westinghouse Propeller Motors. The Propeller Shaft Carries a Propeller at Each End, and Both are Normally Operated by the Two Motors. The Motors are Connected to the Gears Through Flexible Couplings. A Universal Joint, Connecting the Two Halves of the Propelling Shafting, Eliminates the Necessity for Perfect Alinement

In the opinion of Mr. Raymond, this geared arrangement forms an excellent drive and one that deserves careful consideration in designing future boats of this general character. The combined weight of the high speed motors and the gears is less than that of motors of sufficiently slow speed without gears or direct connection to the shaft; a low shaft line is made possible while the motors are raised up where they are accessible, well ventilated, and kept clear of the bilge; perfectly silent operation is obtained at the low peripheral speeds employed; and the life of the gears should be practically unlimited.

Equipment Details

The two cabins of the *Poughkeepsie* will seat 190 passengers. If traffic demands, these cabins can be put on the upper deck. The heating apparatus consists of an Arcola steam heater. An air-operated Strombos horn is used for

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signalling. Fuel-oil tanks with 4,400 gallons capacity—over a month's supply—are located in the compartments at the ends of the hull. The steering gear is of the Thames multiple hand-operated type.

Albert B. Hager, vice-president of the Atlantic, Gulf & Pacific Company, is responsible for the *Poughkeepsie's* construction. Special credit must be accorded S. A. Crum, president of the Poughkeepsie & Highland Ferry Company, for his enterprise in building a boat that marks such an important step in the advance of marine engineering.

Car Ferry Designed to Link Branches of Missouri-Illinois Railroad

IN order to connect the two sections of the Missouri-Illinois railroad, of which ninety miles of main line are in Illinois and forty in Missouri, divided by the Mississippi river, this company recently added the side wheel car ferry *Ste. Genevieve* to its equipment. This ferry was constructed by the Charles Ward Engineering Works, Charleston, W. Va., from designs of Cox and Stevens, naval architects, New York. The ferry is actually intended to act in the capacity of a bridge in handling the traffic of the railroad, which includes a considerable tonnage of coal. The run is extremely short but the ferry will be used continuously so that a craft of rather unusual type was determined upon.

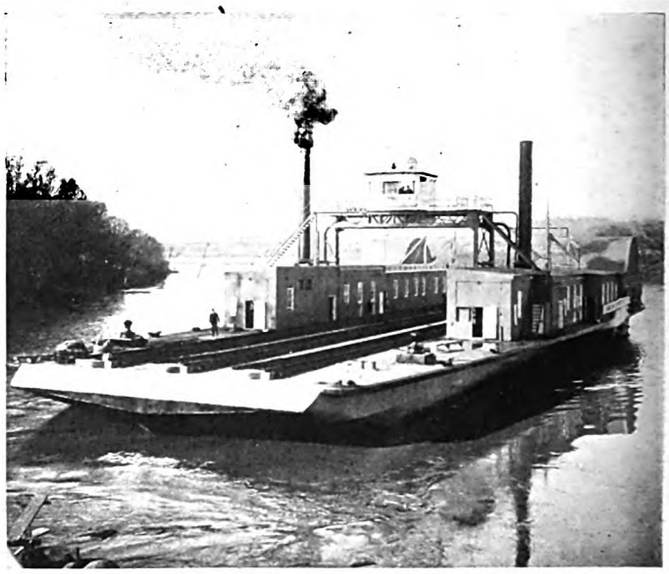
Principal Dimensions

The hull is built of steel to the following dimensions: Length, 285 feet; depth, 11 feet; beam, molded, 54 feet; beam over guards, 86 feet. The ferry is of the single deck side wheel type carrying three tracks with a steel deckhouse containing the machinery, boilers and coal bunkers.

The sponsons carrying the outboard bearings to the wheels are supported by a structural frame spanning the track, and the pilot house, which is of wood, is supported by a structural frame forward of the deckhouse.

Propelling Machinery

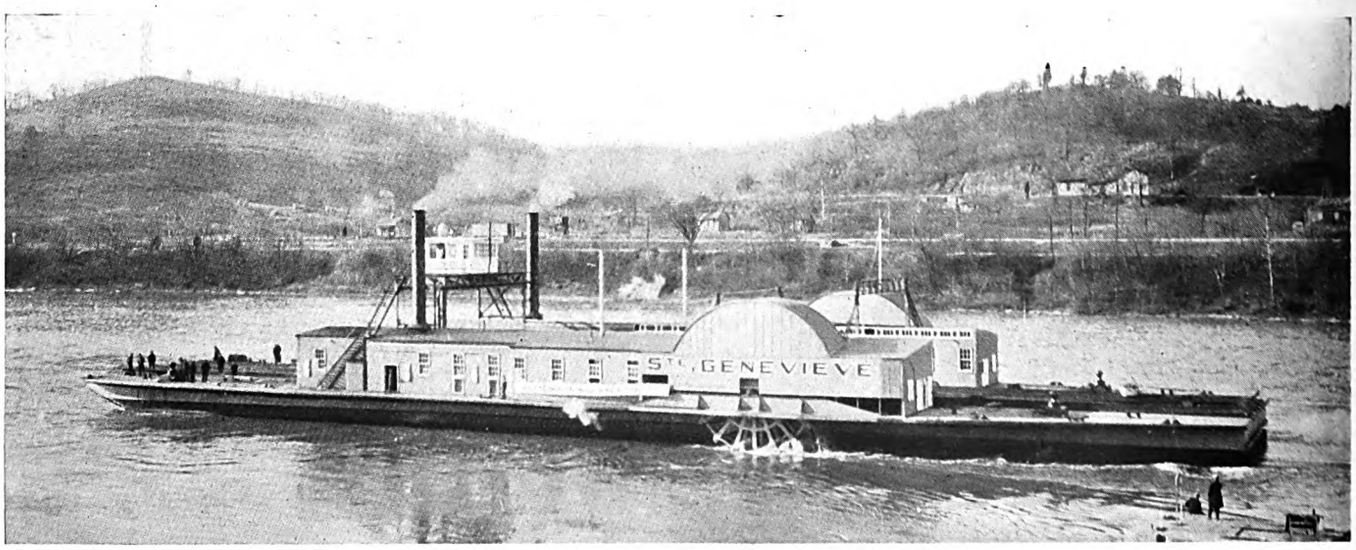
The propelling machinery consists of two simple engines with cylinders 22 inches in diameter by 8 feet stroke for which steam is supplied at 200 pounds per square inch by 6 boilers 44 inches in diameter, 26 feet long, each having ten 6-inch flues. The boilers are equipped with steam jets for cleaning.



Bow View of Car Ferry Ste. Genevieve Showing Arrangement of Tracks and Deck Houses Containing the Propelling Machinery

The paddle wheels are 28 feet in diameter by 12 feet wide. Two rudders are fitted aft which operate by hand or steam power. Under the conditions in which the ferry operates it is necessary that when fully equipped, with the bunkers filled and carrying a load of ten cars of 82 tons each, the draft shall not exceed 5 feet. This was the determining factor in calculating the scantlings of the craft. Wherever possible the weight of the structure was kept to a minimum without sacrificing strength. The requirements that the hull shall be sufficiently rigid to permit carrying a locomotive of 160 tons weight added further complication to the problems of design.

In determining upon the engineering features of this ferry careful attention was given to the local conditions under which it would be required to operate—the shortness of the run and the difficulties to be met in navigating the river. It was determined that a simple non-condensing engine with the customary river type of boiler, in view of its simplicity and ruggedness, was the best possible combination of power equipment.



Car Ferry Ste. Genevieve Built by Charles Ward Engineering Works for Connecting the Main Line of the Missouri-Illinois Railroad Company Across the Mississippi River

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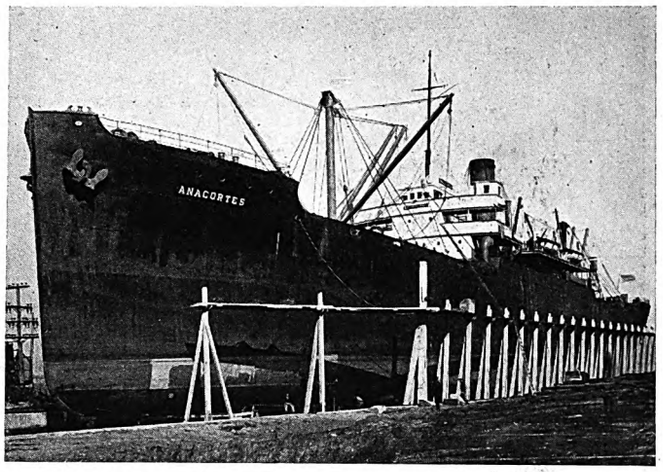
New Railway Dry Dock Operating in Baltimore Repair Yard

AMONG the various forms of ship repair equipment recently taken over by the H. E. Crook Company, Baltimore, Md., from the Union Shipbuilding Company in the operation of the repair facilities of this yard is a new 4,000-ton railway dry dock designed by the Crandall Engineering Company of Boston. This dock was put in commission late in the fall of 1922 when the steamship *Anacortes,* having a displacement of 4,975 tons, was hauled out of the water for repairs. Incidentally, this ship, having a draft of 8 feet 6 inches forward and 15 feet 6 inches aft, was a 25 percent overload for the dock.

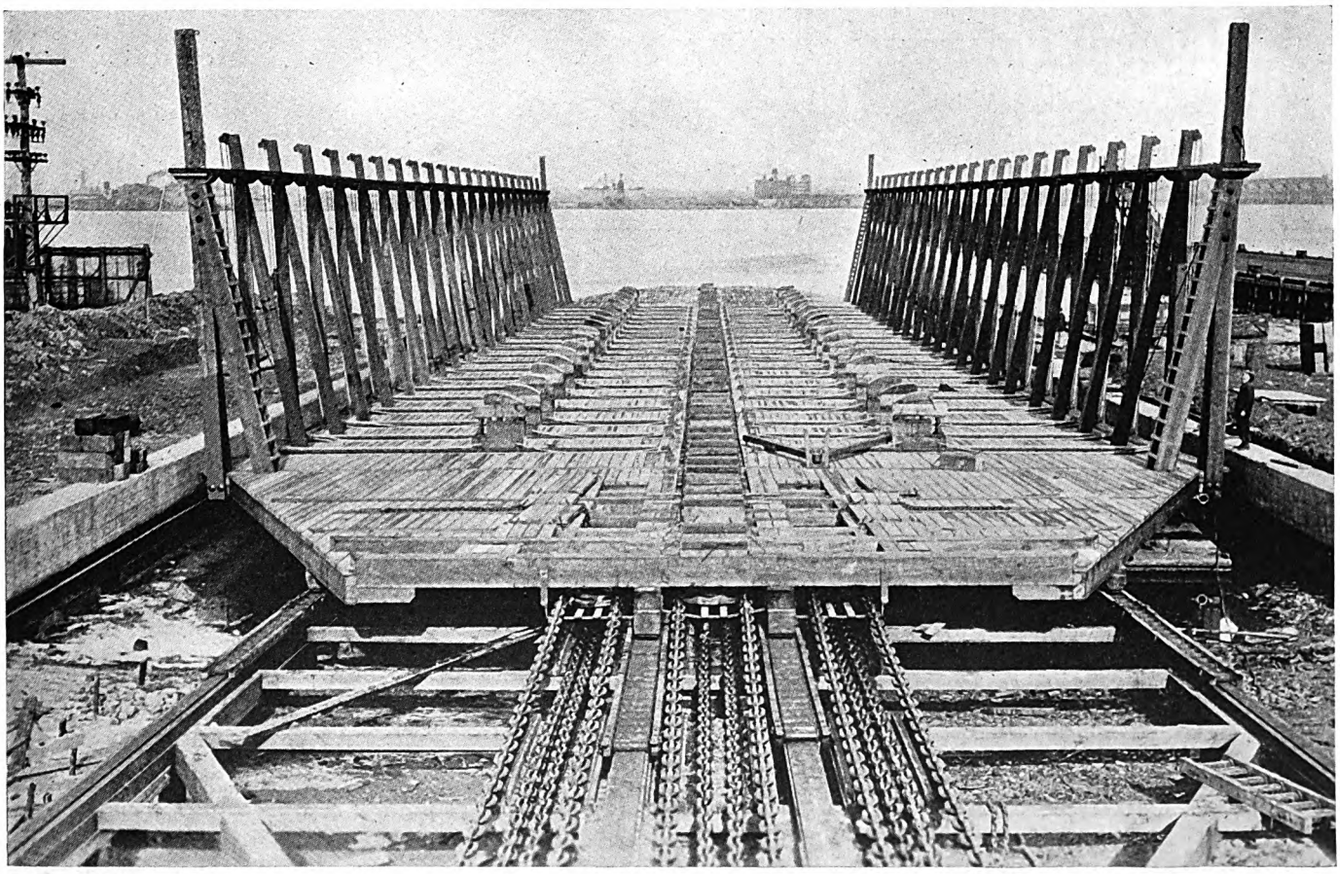
The field engineering force of the Crandall Company carried out the construction. The cradle and track are of heavy timber construction built of long-leaf yellow pine and Douglas fir. The general dimensions of the new dock are: Length on keel blocks, 360 feet; breadth, 70 feet; draft on keel blocks forward, 15 feet; draft on keel blocks aft, 20 feet. It is so built that the keel block line is nearly level so that a ship while being docked is in a horizontal position at all times. The entire dock is decked over forming a safe and convenient platform where the men may carry on their work efficiently. Uprights supporting the docking platforms are erected on each side of the cradle. Winches for operating the bilge blocks along the slides are mounted on the docking platforms. The bilge blocks are equipped with a patent releasing mechanism enabling the blocks to be quickly released and replaced under full load.

The track is of the four-way type resting on a foundation of yellow pine piling driven to hardpan and accurately cut to grading. The cradle runs on the track supported on free rollers working on heavy plates attached to the track and the cradle. The under water portion of the track was built ashore then launched and carefully sunk into place between guides and fastened in position after a further check to assure correct alinement.



Hauling Out the Steamship Anacortes, with a Displacement of 4,975 Tons, on New Crandall Railway Dry Dock in Baltimore

The cradle is drawn by six 2¼-inch marine railway chains attached to the cradle by means of an equalizing device which makes the pull on the several chains uniform. A powerful hoisting machine, composed of a train of heavy spur gearing actuated by a 250-horsepower alternating current motor running on 440-volt, 3-phase, 25-cycle current is used to operate the cradle chains. Automatic brakes are provided and also hand brakes for emergency. Two speeds are arranged for hauling the ship out of the water—the slow speed being capable of lifting the full load in forty minutes.



Crandall 4,000-Ton Railway Dry Dock Installed at Yard of Union Shipbuilding Company, Baltimore

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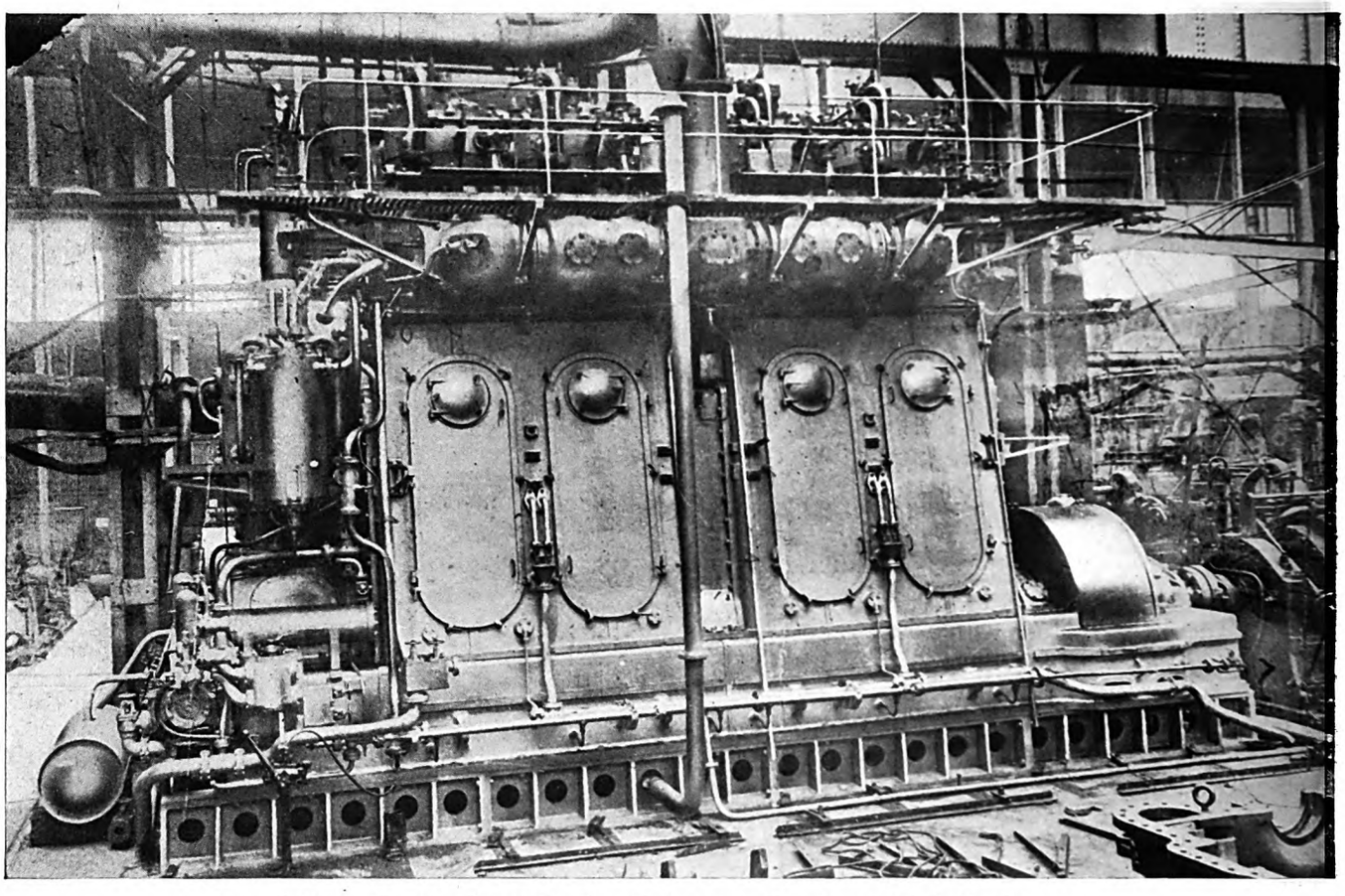

Four-Cylinder Stephen-Sulzer Engine, Designed to Develop 1,600 Brake Horsepower

Diesel Engine Developments in Great Britain

By Our Special London Correspondent

There appears a distinct likelihood of competition between two and four cycle Diesel engines becoming much more acute in the near future than it has been in the past. Hitherto the vast majority of motorships have been equipped with machinery operating on the four cycle principle, and it will probably not be an over-estimate to say that 90 percent of the large oil engined ships afloat are equipped with motors of this class. The belief which engineers hold in the future of the two cycle engine is, however, indicated by the fact that among the 20 or 30 firms in the United Kingdom which have taken up the manufacture of large marine oil engines, some 75 percent have decided to adopt the two cycle type.

IN view of the order that was recently placed by the Union Steamship Company of New Zealand, for a 20,000 ton motor liner in which Sulzer two cycle machinery of 13,000 shaft horsepower will be installed, considerable interest attaches to the completion of the first twin screw sets of this type that have been built in Great Britain. Several ships equipped with Sulzer engines are now in service but the machinery in all cases has been built either almost completely or mainly in Switzerland, and not by their British licensees.

On the Clyde, Messrs. Alexander Stephen & Sons, Limited, are now installing two Stephen Sulzer engines each of 1,600 brake horsepower in the motorship *Dalgoma,* an 11,000 ton cargo vessel for the British Indian Steam Navigation Company, which will run her trials at the end of April. At Denny's yard on the same river, the 10,000 ton tanker *Scottish Borderer* is fitting out and in this vessel two Denny Sulzer engines of 1,250 brake horsepower each will form the propelling equipment. In both cases the whole of the machinery has been built by the Scottish firms, only one or two parts such as fuel valves being supplied by Sulzers themselves from their Swiss works.

Curiously enough there are considerable points of difference in the motors built by Stephen's and Denny's respectively, as will at once be seen by an inspection of the illustrations. In the former, what may be taken as the more modern system is adopted. There is no scavenging pump driven direct off the engine and the necessary scavenging air is supplied from separate electrically driven turbo blowers.

Scavenging By Turbo Blowers

It may be assumed that the power needed for the operation of these blowers is about 5 to 7 percent of the total output of the main engines. Thus with the two sets operating at full power developing 3,200 brake horsepower an electric motor of 200 brake horsepower driving the blower is found to be suitable. Actually two turbo blowers are fitted, one being a standby and the other supplying the necessary air to both propelling engines. It may be remarked that the construction of the electric motors for this purpose calls for some special care, on account of the fact that they run at 2,750 revolutions per minute and have to be of the direct current type operating on the fixed circuit of 220 volts.

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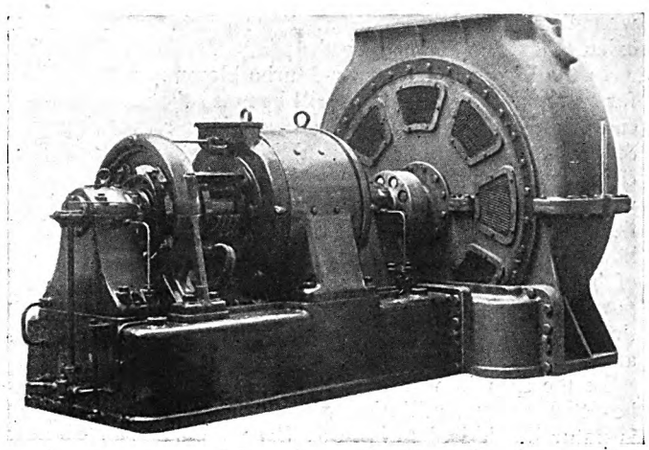
CYLINDER SIZES

These engines have cylinders of 26.77 inches bore and 43.31 inches stroke and run at the relatively low speed of 85 revolutions per minute. Diesel motors with cylinders of the same size, but having a speed of 100 revolutions per minute are now being built, when the output is 2,000 brake horsepower. It is interesting to note that in four Sulzer type engines which are to be installed in the motor liner referred to above, the four cylinders of each engine are of 27.17 inches bore and 38.58 inches stroke, but the speed of revolution is greatly increased, about 135 revolutions per minute being the normal. The output in this case is 3,250 brake horsepower for each engine.

In the Stephen Sulzer motor there is a single two stage air compressor at the forward end and a group of three pumps driven from the crankshaft, two horizontal and one vertical. One of these supplies oil to the crankcase at about 300 pounds per square inch, which is of course much higher than the main lubricating oil supply pressure. Another is a bilge pump and a third a fuel transfer pump. Sea water is utilized for cooling the jackets and covers, while fresh water is employed for the pistons, separate electrically driven centrifugal pumps being installed in the engine room for this purpose.

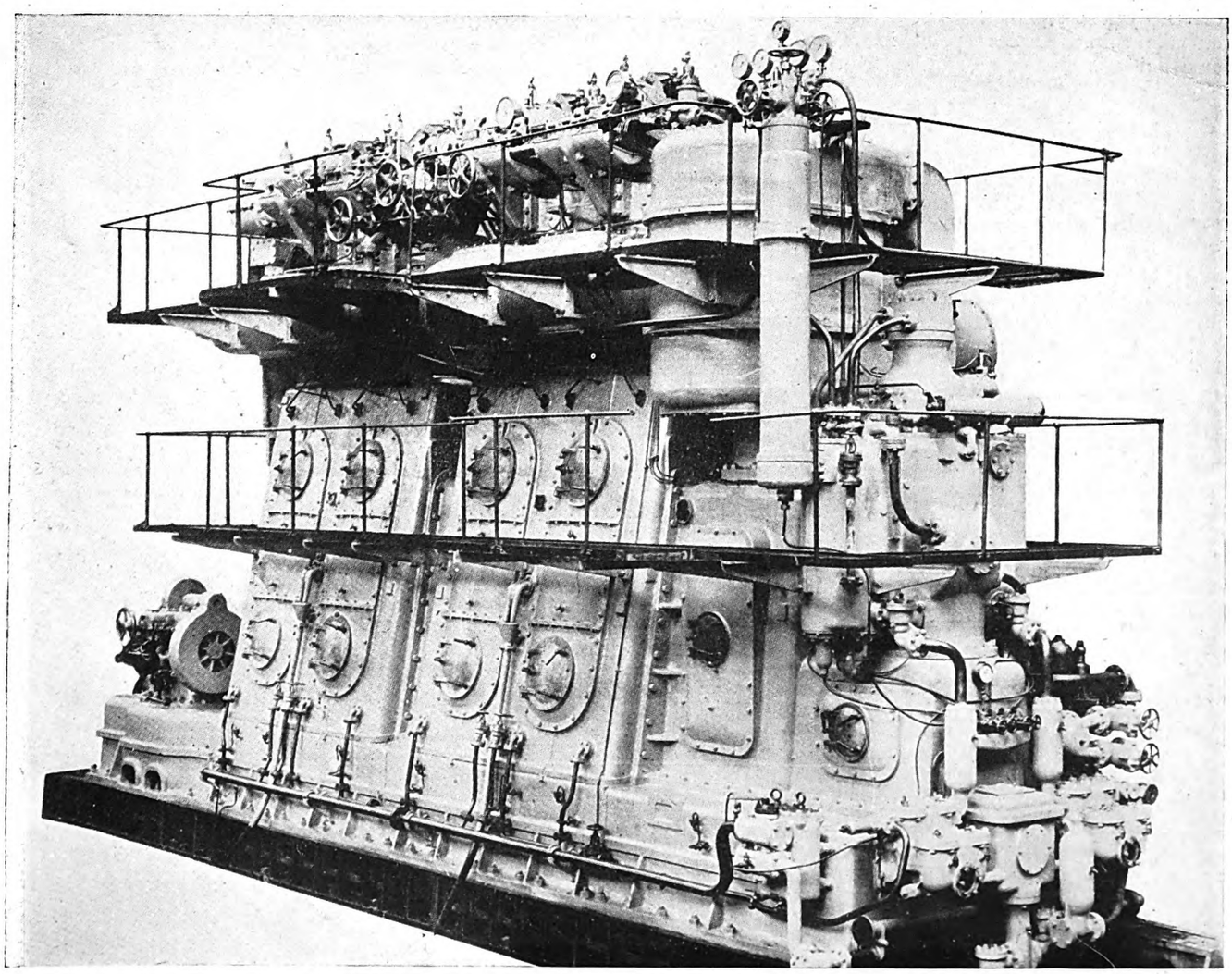
CONTROL LOCATED AT TOP OF CYLINDERS

Unlike most other types of marine Diesel engine, the control station is located on a level with the top of the cylinders.



One of the Turbo Scavenging Blowers Used in Connection with the Stephen-Sulzer Engine

Maneuvering and reversing are carried out in a simple manner since there is only one fuel and one starting air valve in each cylinder actuated by ahead and astern side-by-side cams on the camshaft. The usual Sulzer scavenging system is employed, in which, besides the row of ports in the bottom of the cylinder for the admission of scavenging air, is a further series of supplementary ports above, through



The First Denny-Sulzer Engine. Brake Horsepower at 120 Revolutions per Minute, 1,250

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which air is only admitted after the piston has covered the exhaust ports as it has moved upwards.

In the Denny Sulzer engine, turbo blowers are not utilized for scavenging purposes. It will be noted that at the forward end of the engine is arranged a large piston scavenging pump driven off the crankshaft in addition to the three-stage air compressor. There is probably not much difference in weight and cost between the two systems although, if anything, the advantage rests with turbo scavenging. It is, however, generally thought that for most engines, even of big size, turbo blowers will be used in the future. The power of 1,250 brake horsepower is developed at 120 revolutions per minute, the cylinder diameters being 23½ inches and the stroke 41.7 inches.

In the ship in which the two Denny Sulzer engines will be fitted, steam auxiliaries are to be used throughout and it is naturally desired to have as few as possible in operation when the ship is at sea since oil fired boilers are notoriously uneconomical. The engine is therefore made self-contained and the group of three pumps at the forward end referred to in connection with the Stephen Sulzer engine are utilized for other purposes. One pump is for supplying cooling water to the cylinder jackets and covers, another serves as a bilge pump and the third as a main lubricating oil pump.

At the back of the engine, driven by levers from one of the crossheads is another group of pumps for piston cooling water, crosshead lubrication and the transfer of fuel respectively. Thus when the vessel is at sea no independently driven auxiliaries are needed apart from the small steam driven dynamo supplying current for electric light throughout the ship. Another point in favor of steam driven auxiliaries is that they are less costly although far less economical in fuel. There are, however, special reasons for using steam for this purpose in tankers on account of the suitability of steam engines for driving the cargo pumps, but generally speaking the employment of electricity for operating all the auxiliaries on modern motorships is now becoming almost universal.

Fastest Transatlantic Motor Liners Now Possible

It is a matter of interest that, based upon their experience with a single cylinder 2,000 brake horsepower two cycle engine which Sulzers built some years ago, they have now designed eight cylinder motors of 10,000 brake horsepower which it is understood will be built under the usual guarantee. Thus with a quadruple screw arrangement the fastest transatlantic liners could be equipped with Diesel machinery.

The engine in question would develop its power at 170 revolutions per minute and have cylinders of 33.47 inches diameter and 43.31 inches stroke. The mechanical efficiency would be 74 percent and the indicated horsepower 12,600. The weight of the engine without accessories would be 525 tons and scavenging air would of course be supplied from electrically driven turbo blowers. The piston speed would be 1,230 feet per minute, which is admittedly somewhat high and the mean indicated pressure about 95 pounds per square inch. For each engine the power absorbed by the blower would be 700 brake horsepower.

In a quadruple screw arrangement of 40,000 shaft horsepower there would be four auxiliary engines each of 1,000 brake horsepower driving dynamos. These would run at 240 revolutions per minute. The proposal is interesting as showing the confidence which Diesel engine builders now feel in developing motors of large power.

High Pressure Gas Regulator

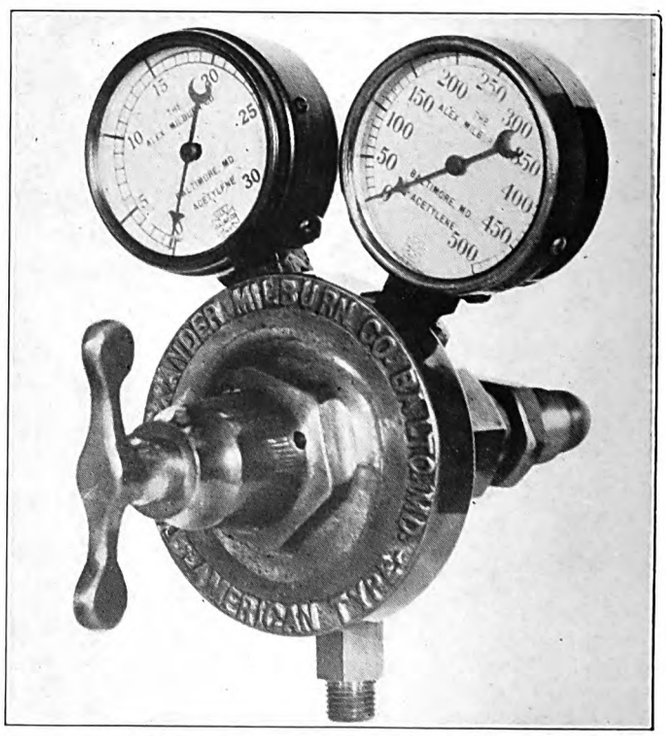
FOR the control and delivery of acetylene, oxygen, hydrogen and other high pressure gases, the Alexander Milburn Company, Baltimore, Md., has developed the gas regulator shown. Features of this device are said to be simplicity, ease of assembly, direct action and accurate regulation.

The regulator comprises a front cap containing an adjusting key, top spring button and tension spring. The body contains a flexible metal diaphragm in front, soldered in place. Over the diaphragm is screwed a bronze diaphragm plate or spring button to hold the tension spring. Inside the body is a fixed nozzle, containing a loose operating pin. Over the nozzle is loosely assembled the valve sleeve which has a row of gas ports drilled around its circumference and carries the valve seat. The seat closes against the nozzle by initial gas pressure on the valve sleeve and the pressure of a compensating spring resting in the recessed back cap.

The loose operating pin inside the nozzle is actuated at one end by a depression of the diaphragm and at the other end by pressure of the valve seat.

The seat of the regulator closes *with* instead of *against* the pressure, enabling the seating to be effected by a sealing pressure of several pounds instead of hundreds of pounds with attendant risk of damaging or splitting the seat, as in the case of regulators where the seat is yoked to the diaphragm. The closing of Milburn seat is independent of the diaphragm.

The valve is closed by the rear pressure of the compensating spring, assisted by initial gas pressure. When the adjusting key is turned to the right, the tension spring depresses the diaphragm, moving the loose pin, which forces the sleeve back, unseating the valve and permitting gas to enter through ports in the sleeve. The gas then passes through the nozzle to the diaphragm chamber and thence to the low pressure gage and through the outlet port. When multiplied gas pressure exceeds the tension of the adjusting key spring, the diaphragm is released, permitting the loose pin to advance and letting the valve sleeve close the valve by pressure of the rear compensating spring.



Milburn High Pressure Gas Regulator

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Selection of the Best Kind of Propelling Machinery*

Comparison of Vessels Equipped With Various Types of Propelling Machinery — Discussion of Factors Influencing Selection of Best Type

By J. L. Ackerson†

NEVER before has the marine engineering fraternity had so many different types of propelling machinery to select from, and there is no empirical formula which can be applied to help select the best type. The problem of the shipowner in this respect is the most important one he has today. Among the many factors to be considered in deciding what is the most suitable type are reliability (this is the most important single factor, for without reliability other advantages are very much discounted); economy in operation, initial cost, and weight, the relative importance of the last three depending on the type of ship under consideration.

Reliability

Reliability is something less tangible than the other three and responsibility less easily placed, because the factors controlling reliability emanate from two different sources: (1) The owner, through the selecting of competent personnel; and (2) the builder. No matter how well a machine has been designed and constructed, if placed in the hands of an incompetent operator, it will become unreliable; and *vice versa,* no matter how good the operating engineer, if the proper factors have not been used in the design and care in the construction, then the machinery is again unreliable; so that it is absolutely necessary for the operator thoroughly to understand and be whole-heartedly in support of any new design, and for the designer to realize that the cost of fuel per horsepower, while important, is not the only consideration. In the past five years we have had a very costly experience through sending to sea a large number of units (the design of which to begin with is questionable) in charge of engineers who were only half trained.

Economy

Economy in operation (that is, the fuel per horsepower) and initial cost usually bear a very close relation to each other, and it is only a question of figures to determine whether any particular type is worth the money as compared with any other type; and here again the type of vessel and the trade the vessel is employed in play an all-important part, as for example, most tramp steamers over a cycle of, say seven years, are laid up for considerable periods at a time owing to there being no freight. During this lay-up the portion of expense due to fixed charges is going on all the time, while that portion consisting of fuel and supplies and operating personnel stops when the ship is laid up.

Weight

Weight is the least important except in the case of special types like shallow-draft boats, express-type steamers, warships, etc., because except in special trades—*viz.,* coal, ore or oil-carrying—it is seldom that a ship is loaded down to a loaded draft mark, even when full of cargo.

With this brief introduction I will now present comparisons of the following different types of machinery and ships:

Geared turbines with Scotch boilers.
Geared turbines with watertube boilers.
Reciprocating steam engines with Scotch boilers.
Reciprocating steam engines with watertube boilers.
Diesel engine 4-cycle.
Diesel engine 2-cycle.
For 5,000-ton freighter at 10½ knots.
For 7,500-ton freighter at 11 knots.
For 8,800-ton freighter at 10½ knots.
For 10,000-ton freighter at 12½ knots.
For 10,500-ton tanker at 10½ knots.
For 17,000-ton displacement passenger ship at 15 knots.

From Table I the one outstanding feature is the greater savings for Diesel-engine ships in the long-voyage trades, and this is chiefly due to the saving of cargo space required for carrying fuel oil rather than to the saving in cost of fuel oil, operating personnel, and fixed charges. Also, that for short voyages the Diesel engine should be given very careful consideration before a selection of the type to be used is made.

The different comparisons show that there is not much difference between the weight of Diesel engines and steam reciprocating engines, but it should be borne in mind that for steamers up to 12 knots speed the revolutions per minute of the Diesel engine are considerably higher than those of the corresponding steam engines—in the ratio of about 110 to 75. This undoubtedly means a less efficient propeller for all single-screw types. On faster boats the advantages of the slower revolutions per minute gradually disappear. In comparing weights, allowance should be made for reserve feed water for the steamer; if this is done, steam-engine weights will invariably be greater than Diesel-engine weights for voyages of ten days and over, except in the case of larger power geared-turbine jobs than those now under consideration.

It should also be noted that, whereas powers of four to five thousand are possible on single-screw steam installations, it is necessary to go to twin-screw installations for Diesel engines. This incurs an extra cost in hull construction, necessitating two shaft alleys which cut up the after holds and make it more difficult to stow cargo, as well as actually decreasing the cubic of the holds.

Originally it was my intention to resolve the saving in cargo space due to fuel-oil requirements into dollars per year, but owing to the uncertainty of freight rates I gave up the idea as being impracticable and have shown this advantage in tons per voyage. The alternative to carrying this large quantity of fuel oil would be to buy it at the ports of call. Which choice would be the better would depend, of course, on the price of the fuel oil at, and the freight rate to, those particular ports.

The initial costs listed in Table I may be open to criticism, owing to prices being so spotty and varied at the present time. These prices are based on firm quotations of the lowest reputable bidder and include machinery installed ready for use. The same remark applies to weight. Different builders vary considerably, but, whatever error there is, the percentage of error will be the same for all types and will be in the same direction; and as it is the difference in cost and the difference in weight which we are most interested in, the percentage of error will be very small.

The machinery weights do not include hull engineering or any portion of the machinery usually located in the engine room but necessary for deck machinery only, such as auxiliary generating sets for generating electricity to be used on electric deck machinery.

* Paper read before the Society of Naval Architects and Marine Engineers, New York, November 9, 1922.

† Vice-president, Merchant Shipbuilding Corporation, Chester, Pa., and president, Atlantic Coast Shipbuilders' Association.

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TABLE I

Type of Ship	Machinery: Type	Machinery: Weight, Tons	Machinery: Initial Cost	Cost of Fuel at Sea per Day	Cost of Fuel per Year: 200 Days at Sea	Cost of Fuel per Year: In Port	Cost of Fuel per Year: Total	Cost of Operating Personnel	Depreciation Charges 15%	Total Cost per Annum	Feed Water Make Up per Day, Tons	Fuel Oil Required for Following Distances Allowing 15% Margin, Tons: 5,000 M.	10,000 M.	15,000 M.	20,000 M.	Inner Bottom Tank Capacity, Tons	Cargo Space Taken Up for Fuel Oil for Following Distances, Tons: 5,000 M.	10,000 M.	15,000 M.	20,000 M.
5,000 Ton Freighter 10½ Knots, Single Scr. 1,650 I.H.P.	R. E. & S. B.	380	$167,000	22 tons $220	$44,000	$1,650	$45,650	$13,920	$25,000	$84,590	6	440	880	1,320	1,760	680	0	200	640	1,080
	R. E. & W. T. B.	316	163,000	22 tons $220	44,000	1,650	45,650	13,920	24,500	84,070	6	440	880	1,320	1,760	Above Feed Water Requirement	0	200	640	1,080
5,000 Ton Freighter 10½ Knots, Single Scr. 1,500 S.H.P.	G. T. & S. B.	355	175,750	22 tons $220	44,000	1,650	45,650	13,920	26,400	85,970	6	440	880	1,320	1,760		0	200	640	1,080
	G. T. & W. T. B.	291	171,000	22 tons $220	44,000	1,650	45,650	13,920	25,600	85,170	6	440	880	1,320	1,760		0	200	640	1,080
	4 Cycle Diesel	400	207,000	7¼ tons $84	16,800	495	17,295	12,360	31,000	60,655	0	145	290	435	580		0	0	0	0
	2 Cycle Diesel	350	222,000	7¼ tons $84	16,800	495	17,295	12,360	32,000	62,855	0	145	290	435	580		0	0	0	0
7,800 Ton Freighter 11 Knots, Single Screw 2,700 I.H.P.	R. E. & S. B.	625	$230,000	34 tons $340	68,000	1,650	69,650	14,280	34,500	118,430	8	650	1,300	1,950	2,600	1,038	0	262	912	1,562
	R. E. & W. T. B.	538	224,000	34 tons $340	68,000	1,650	69,650	14,280	33,600	117,530	8	650	1,300	1,950	2,600	Above Feed Water Requirement	0	262	912	1,562
7,800 Ton Freighter 11 Knots, Single Screw 2,500 S.H.P.	G. T. & S. B.	570	244,000	34 tons $340	68,000	1,650	69,650	14,280	36,600	120,530	8	650	1,300	1,950	2,600		0	262	912	1,562
	G. T. & W. T. B.	483	239,000	34 tons $340	68,000	1,650	69,650	14,280	35,800	119,730	8	650	1,300	1,950	2,600		0	262	912	1,562
	4 Cycle Diesel	650	307,000	11 tons $130	26,000	490	26,490	12,720	46,000	85,210	0	210	420	630	840		0	0	0	0
	2 Cycle Diesel	540	327,000	11 tons $130	26,000	490	26,490	12,720	49,000	88,210	0	210	420	630	840		0	0	0	0
8,800 Ton Freighter 10½ Knots, Single Scr. 2,700 I.H.P.	R. E. & S. B.	625	$230,000	34 tons $340	68,000	1,650	69,650	14,280	34,500	118,430	8	680	1,360	2,040	2,720	1,140	0	220	900	1,580
	R. E. & W. T. B.	538	224,000	34 tons $340	68,000	1,650	69,650	14,280	33,600	117,530	8	680	1,360	2,040	2,720	Above Feed Water Requirement	0	220	900	1,580
8,800 Ton Freighter 10½ Knots, Single Scr. 2,500 S.H.P.	G. T. & S. B.	570	244,000	34 tons $340	68,000	1,650	69,650	14,280	36,600	120,530	8	680	1,360	2,040	2,720		0	220	900	1,580
	G. T. & W. T. B.	483	239,000	34 tons $340	68,000	1,650	69,650	14,280	35,800	119,730	8	680	1,360	2,040	2,720		0	220	900	1,580
	4 Cycle Diesel	650	307,000	11 tons $130	26,000	490	26,490	12,720	46,000	85,210	0	220	440	660	880		0	0	0	0
	2 Cycle Diesel	540	327,000	11 tons $130	26,000	490	26,490	12,720	49,000	88,210	0	220	440	660	880		0	0	0	0
10,000 Ton Freighter 13 Knots Single Scr. 4,600 I.H.P.	R. E. & S. B.	910	$363,000	57 tons $570	114,000	3,300	117,300	14,640	54,500	186,440	12	910	1,820	2,730	3,640	1,090	0	730	1,640	2,550
	R. E. & W. T. B.	750	352,000	57 tons $570	114,000	3,300	117,300	14,640	53,500	185,440	12	910	1,820	2,730	3,640	Above Feed Water Requirement	0	730	1,640	2,550
10,000 Ton Freighter 13 Knots Single Scr. 4,200 S.H.P.	G. T. & S. B.	780	346,000	47 tons $470	94,000	3,300	97,300	14,640	52,000	163,940	12	760	1,520	2,280	3,040		0	430	1,190	1,950
	G. T. & W. T. B.	620	336,000	47 tons $470	94,000	3,300	97,300	14,640	50,500	162,440	12	760	1,520	2,280	3,040		0	430	1,190	1,950
10,000 Ton Freighter 12¼ K. Twin S. 3,400 S.H.P.	4 Cycle Diesel	900	524,000	15 tons $173	33,600	495	34,095	16,140	78,600	128,835	0	256	512	768	1,024		0	0	0	0
	2 Cycle Diesel	800	547,000	15 tons $173	33,600	495	34,095	16,140	82,200	132,435	0	256	512	768	1,024		0	0	0	0
10,000 Ton Tanker 11 Knots, Single Screw 2,750 I.H.P.	R. E. & S. B.	587	$237,000	34 tons $340 (300 Days at Sea)	102,000	650	102,650	14,280	35,500	152,430	8	650	1,300	1,950	2,600	Could All Taken Up by Reserve Feed Water Could Be Used As Cargo Space	650	1,300	1,950	2,600
	R. E. & W. T. B.	500	228,000	34 tons $340	102,000	650	102,650	14,280	34,200	151,130	8	650	1,300	1,950	2,600		650	1,300	1,950	2,600
10,000 Ton Tanker 11 Knots, Single Screw 2,500 S.H.P.	G. T. & S. B.	532	253,000	34 tons $340	102,000	650	102,650	14,280	38,000	154,930	8	650	1,300	1,950	2,600		650	1,300	1,950	2,600
	G. T. & W. T. B.	445	246,000	34 tons $340	102,000	650	102,650	14,280	37,000	158,930	8	650	1,300	1,950	2,600		650	1,300	1,950	2,600
	4 Cycle Diesel	653	330,000	11 tons $130	39,000	195	39,195	12,720	49,500	101,415	0	210	420	630	840		210	420	630	840
	2 Cycle Diesel	545	352,000	11 tons $130	39,000	195	39,195	12,720	52,600	104,515	0	210	420	630	840		210	420	630	840
17,000 Ton Passenger 15 Knots, Twin Screw 8,000 I.H.P.	R. E. & S. B.	1,700	$720,000	94 tons $940 (200 Days at Sea)	188,000	3,300	191,300	32,940	108,000	332,240	16	1,300	2,600	3,900	5,200	1,200	100	1,400	2,700	4,000
	R. E. & W. T. B.	1,400	700,000	94 tons $940	188,000	3,300	191,300	32,940	105,000	329,240	16	1,300	2,600	3,900	5,200	Above Feed Water Requirement	100	1,400	2,700	4,000
17,000 Ton Passenger 15 Knots, Twin Screw 7,200 S.H.P.	G. T. & S. B.	1,440	580,000	77 tons $770	154,000	3,300	157,300	32,940	87,000	277,240	16	1,075	2,150	3,225	4,300		0	950	2,025	3,100
	G. T. & W. T. B.	1,140	560,000	77 tons $770	154,000	3,300	157,300	32,940	84,000	274,240	16	1,075	2,150	3,225	4,300		0	950	2,025	3,100
	4 Cycle Diesel	1,840	800,000	31 tons $360	72,000	495	72,495	27,000	120,000	219,495	0	435	870	1,305	1,740		0	0	105	540
	2 Cycle Diesel	1,510	855,000	31 tons $360	72,000	495	72,495	27,000	128,000	228,495	0	435	870	1,305	1,740		0	0	105	540

R.E.—Reciprocating Engine
G.T.—Geared Turbines
S.B.—Scotch Boilers
W.T.B.—Water Tube Boilers

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I have not given the cubic required for the machinery space, because in all cases the space required is so near the 13 percent required by the United States tonnage rules as not to justify the loss of the 33 percent deduction to gross tonnage, which is permitted when machinery space is at least 13 percent of the cubic of the ship.

I have not dealt with the engines which offer the greatest saving in space and weight, because up to the present time none has been built in this country, but it would appear to me that the opposed piston type of engines like the Fullagar and the Doxford offer many advantages that cannot be overlooked by the prospective shipowner.

From reports available, the *Yngaren,* fitted with a 3,000-horsepower opposed piston-type engine, made by the Doxford Company, has given an excellent account of herself for her maiden voyage from the British Isles to Australia and back. This engine offers one or two very desirable features, *viz.,* a slow-running engine for comparatively large powers, with the consequent efficient propeller, considerably smaller engine-room space and one shaft alley only.

Owing to the Diesel engine builders standardizing around an engine of 2,500 shaft horsepower, I have used this power upon ships of 7,500 to 8,800 tons and on a 10,500-ton tanker. This assumption makes machinery for these types cost and weigh about the same but gives us slightly different speeds. (The above figures hold good only so far as new machinery is concerned.)

It so happens, however, that at the present time there is hanging over the market a very large tonnage owned by the Emergency Fleet Corporation and available at very much lower prices than the present actual cost for replacing the same.

To convert any one of these 7,500 to 12,000-ton steamers into Diesel engine-driven boats, with 2,500 shaft horsepower Diesel engines, maintaining the existing auxiliary steam-driven machinery and deck machinery, would cost approximately $400,000, and this same change, together with changing the auxiliaries and deck machinery to the electric drive, would cost in the neighborhood of $550,000.

The first proposal would save the shipowner approximately 18 tons of oil a day; the second would save him about 22 tons of oil a day. For 200 days a year at sea and 165 days in port at $10 a ton for oil, the total saving for steam auxiliaries and Diesel propelling engines in oil would be about $36,000, and the extra for fixed charges would be $60,000. For Diesel propelling engines and electric deck machinery the initial cost would be in the neighborhood of $550,000. Saving in fuel oil would be 22 tons for 200 days and 5 tons for 165 days at $10 a ton—$53,000—and the extra due to fixed charges would be $83,000. The extra cost of lubricating oil for the Diesel engine will be offset by the decrease in cost of operating personnel, so that, assuming the same price, whether the owner will run the ship as a motorship or as a steamship, the conversion is not justifiable except for the long voyages; but if these ships can be bought for conversion purposes at $30 a ton less than would be paid to continue as steamships, the fixed charges are reduced on a 10,000-ton ship to $37,000, and for almost any trade this change would be justifiable.

For conversion from steamers to motorships under the Shipping Board plan, where new Diesel machinery must be had, it would appear that the larger boats offer the best possibilities.

Before closing I should like to say that, while I have taken 200 days at sea and 165 days in port per year for all the types except the tanker, this figure must, of course, depend on the trade the vessel is employed in. There are some trades where a ship is in port almost half the time, and it must be remembered that while a ship is in port it is not earning anything while the fixed charges are still going on. Therefore the more costly propelling machinery is at a disadvantage as compared to a cheaper type running only a small portion of the time.

While I consider Table I a good guide, the only way the best type can be selected is by a careful comparison of the different types in the particular trade an owner wishes to engage in along the lines given in the table, taking into account the character of the freight, length of voyage, freight rates, cost of fuel oil at ports of call, etc.

Diesel Engine Electric Ship Propulsion*

By W. H. Wild†

SINCE 1904 there have been completed and placed in service approximately eight hundred motorships above two hundred brake horsepower capacity each and, no doubt, the fuel economy of the Diesel engine, as compared with steam driven machinery, has been the greatest factor in this rapid development.

Diesel electric drive permits of single screw operation, even though more than one engine is used, and the most efficient propeller speeds may be adopted regardless of the number or speed of the engines used. This means it will be possible to standardize the engine, and the designing engineer is at liberty to produce the most efficient and reliable engine without limitation as to speed or size. The engine that lends itself best for manufacture may be adopted and then install two, three, four or more engines depending on the power required. This will reduce the cost of manufacture.

Savings in Weight and Space

In some ships space and weight are of prime importance. The electric drive does not require the generating sets to be placed in any definite position with respect to the propeller shaft and, therefore, the equipment can be installed to the very best advantage. The question of weight is largely dependent on the rotative speed of the engine and since the electric drive permits using a multiplicity of engines it will be found that the weight of the complete equipment including the electric apparatus will frequently be in favor of the electric drive.

The loss of energy in the electrical apparatus is often pointed out as a serious handicap. This loss, in direct current equipments, may amount to as much as 17 percent, and with alternating current equipments somewhat less, when compared with direct connected propellers running at a speed which is suitable for the highest propeller efficiency. This loss is offset in electric driven ships by using single screws in place of twin screws; adopting the most efficient propeller speed; the most efficient engine speed, and in many other ways. When less than full speed is required one or more units may be shut down thereby effecting a large saving in operating costs.

Pilot House Control Possible

The maneuvering advantages of electric drive are of considerable importance for many types of ships such as barges, tugs, fishing boats, ferries, coastwise ships, etc. It also provides a simple means of cutting engines out of service for overhaul at sea or for making simple adjustments. Pilot house control can readily be installed, if desired.

Nearly all motorships are being fitted with electric auxiliaries and Diesel driven auxiliary generators. The auxiliary generating units may often be dispensed with in the electric driven ship with the possible exception of a small set for port use; the main engine generators being used for supplying auxiliary power. In many ships this would permit a saving of thousands of dollars in first cost as well as

*From a paper read before the Ocean Engineers' Association, New York.
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a large saving in upkeep. This advantage is of greater or less importance, of course, depending on the relation of auxiliary power required as compared to the main propelling power.

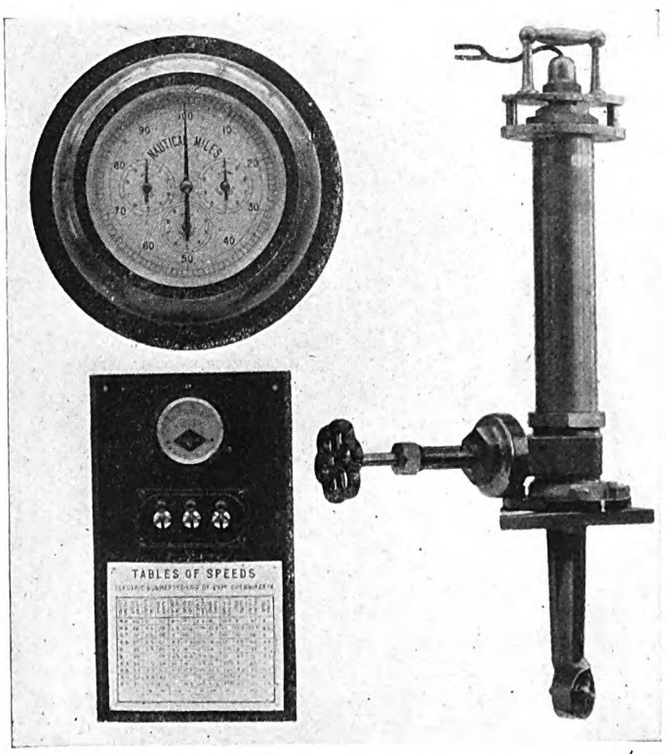
Reliability and Continuity of Service

Finally, those interested in marine activities desire most reliability or continuity of service. The equipment which can demonstrate the greatest reliability, with the other characteristics reasonably comparable, is bound to find an important place in ships' drive. As for the electrical equipment the major part of all movement is simple rotation, which enhances the great reliability of this apparatus. It has been in successful operation for years on land in every conceivable power application and in the past 10 years thousands of horsepower have been applied to the successful propulsion of ships.

When the electric drive is applied to motorships it is the practice to install two or more engine-generators and mount two motors on the propeller shaft of single screw ships which in reliability is equivalent to a twin screw ship except for the fact that but one propeller is used. Therefore, while the power is generated by engines which involve reciprocating motion, the power is transmitted to the propeller shaft through a motor which involves simple rotation only, and the generating plant can be composed of a sufficient number of units to insure 100 percent continuity of service without sacrificing its economy.

Electric Submerged Log

AN electro mechanical log which will register accurately at low speeds of a vessel is being manufactured by the Electric Submerged Log Company, 33 and 35 Eastcheap, London, E. C. 3, England. The log consists of an electro mechanical device fitted to the hull of a ship at a predetermined depth and at a point where wave and propeller disturbances do not occur. The principle upon which the device works is the conversion of the mechanical action of a small rotator into electric impulses which are transmitted by wire to a registering device in the wheel house.



Registering Device and Submerged Unit of Electro Mechanical Log

The submerged unit of the equipment is connected to the hull of the vessel so that a short section containing the rotator projects outside the hull while another part is inside the vessel. The interior mechanism includes a flange, sluice valve, main tube, stuffing box and a handle. The exterior mechanism comprises a submerged support, an electrical contact casing and the rotor. The contact casing contains the terminal contact of an insulated wire connected to the batteries and the indicating apparatus. An insulated spring makes contact with the commutator or make-and-break disk. The rotator is secured to its ring by a key and screw, the motion being transmitted from the shaft through double worm and wheel gears to the make-and-break disk. This disk makes twenty revolutions per mile of ship's travel.

The distance registering apparatus in the wheel house is calibrated to indicate distances of one-twentieth of a mile corresponding to the rotation of the make-and-break disk up to 10,000 miles. A panel comprising a voltmeter and table of speeds is also provided, with three switches used to connect the voltmeter to a test battery, to connect the recording dial in circuit and to connect a buzzer used for determining the speed of the vessel. This buzzer gives an audible signal every twentieth of a mile traversed and, with the aid of a stop watch, the actual speed can readily be determined.

Notes on Sublimed Blue Lead

SUBLIMED blue lead in the dry state as it comes from the smelter is used in the manufacture of paints and rubber. The Eagle-Picher Lead Company sells the dry product to paint manufacturers and to rubber manufacturers. It also grinds the sublimed blue lead with pure raw linseed oil and markets it in paste form ready to mix with oil, drier and thinner for rust-proofing purposes.

Linseed Oil

The vehicle is just as important as the pigment in determining the quality of a rust-proofing paint. There has been a long sustained effort on the part of paint technicians to develop other oils that could be substituted for a linseed oil, but up to the present time there is no oil that can be counted on to give the service that can be obtained with pure raw linseed oil.

Boiled linseed oil is specified by many for use with Sublimed Blue Lead because it dries quicker. Raw linseed oil can be given the same drying characteristics by adding suitable drier, and many believe that superior durability is obtained with raw oil.

Linseed oil has been exhaustively studied and engineering specifications for judging its suitability for paint surfaces have been prepared by, and may be obtained from, the American Society for Testing Materials.

Physical Properties of Sublimed Blue Lead

Dry sublimed blue lead is a slate gray colored pigment of an almost impalpable fineness. With the exception of lamp black, sublimed blue lead is the finest pigment in use today, the particles being of the order of 0.0002 millimeter (0.2) in diameter. An idea of how small this really is may be obtained by comparing this with cement particles. Ordinary dry cement leaves approximately 22 percent on a 200-mesh screen, while sublimed blue lead will pass completely through a 325-mesh screen. A 200-mesh screen has 40,000 holes per square inch, while a 325-mesh screen has 106,000 holes.

The specific gravity of sublimed blue lead is 6.67, that is, it weighs 6.67 times as much as an equal volume of water. One solid gallon weighs 55.56 pounds and one pound bulks 0.018 of a gallon.

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Propellers

How the Design of Propellers May Be Improved by Scientific Application of Model Test Data

By Alfred J. C. Robertson*

AT the November meetings of the Society of Naval Architects and Marine Engineers three scientific papers were read on Propellers and this is a fair indication that marine engineers and naval architects are coming to realize that the old methods of design are not sufficient to meet present conditions satisfactorily.

There is no doubt that the last few years have shown a notable improvement in the design of slow speed ships, which represent about 90 percent of vessels built, so that today designers are able to produce such ships with resistances of not more than say 10 percent above the minimum. Such results are largely due to increasing knowledge and understanding of model experiments, many of which, on low speed ships, have been made public in recent years.

On the other hand, it is not at all an unusual experience, when a change of propeller has been indicated, to find the speed of ship altered as much as a knot, representing perhaps 25 percent saving (or increase) in power.

Conditions Altered By Use of Geared Turbines or Diesel Engines

The growing use of geared turbines or Diesel engines has at the same time largely discounted the value of accumulated propeller experience with reciprocating engines. These in most cases have been of the slow speed type permitting pitch ratios of 1.2, 1.3 and 1.4 whereas Diesel engines at present run at least 50 percent higher in revolutions for the same piston speed and machinery weight, giving pitch ratios of 0.80 to 0.95, with even higher relative speeds for single reduction geared turbines. For double reduction gearing lower speeds are available but the cost and weight of such gearing become almost prohibitive. In this case also, therefore, engineers are anxious to use propellers of the lower pitch ratios.

An additional incentive to the study of propeller design is provided in the case of Diesel engines because of the lack of elasticity of this type of prime mover. In reciprocating steam engines, if a propeller proves heavier in pitch or diameter than it should be, the revolutions of course drop, but it is usually possible to secure just as much power as was provided in the design by increasing the mean effective pressure in the cylinders.

In Diesel engines this advantage is denied us, because the design already makes use of the highest mean effective pressure which it is quite safe to use and any increase of that pressure is likely to produce troubles of various kinds through overheating, such as burning out valves and valve seats, cracking cylinder heads, etc.

Experimental Tank Data Not Appreciated By Practical Men

When therefore further knowledge of propellers is called for we naturally look to the work of the experimental tanks which have been of such assistance to us in the design of ships' hulls.

A considerable volume of such data has been available for some time but until recently it has been looked upon with grave suspicion by practical men; and this for three reasons: First, because practical men hardly understand or appreciate the attitude of scientific men—that attitude which realizes and sometimes expresses a consciousness of vast realms of knowledge of which we have only touched the border, and secondly because propellers on ships will not give identical results with their models on model ships, and thirdly because of necessity model propeller data must be compiled independently of the ship with which it is desired to fit a propeller and the interaction between hull and propeller is still somewhat obscure.

But we are all becoming more scientific so that the first of these reasons should not deter us from the use of what knowledge exists and such knowledge will carry us along, perhaps not perfectly, but quite tolerably well, even if it be ultimately modified or displaced as they tell us Newton's most useful theory of gravitation has been displaced by more accurate knowledge.

Model Tests Dispelling Doubt

The second reason is quickly vanishing as tests on full powered ships have been compared with the model tests and correction factors adduced, and the third reason will lose much of its force when we have before us such excellent papers as Professor Bragg's and Admiral Taylor's which deal very largely with the effect of a ship's hull upon the flow of water to the propeller.

Admiral Taylor's paper deals with tests made on one ship model with propellers of three different proportions and characteristics, located on a high and a low centerline, at three positions abaft the sternpost. In each case the model was driven by its own propeller at various speeds which practically covered the range of speeds at which a ship of the form of the model could be profitably operated. Careful records were taken and compared with the records made by the same propellers without the ship, i.e., in still water, and from these records the effect of the ship's wake upon the propeller, the suction or thrust deduction of the propeller upon the ship, and the hull efficiency resulting from these opposite forces, were arrived at.

Professor Bragg's paper records the results of many experiments to measure the speed of the water behind a ship where a propeller might be located.

Advance of Propeller Must Be Known

The significance of both of these investigations lies in the fact that the actual speed of a propeller through the water must be known, if the power it absorbs in torque or the power it delivers in thrust are to be known. Taylor's paper of course takes us further by giving us data as to whether the power delivered by the propeller (thrust) should or should not be equal to the resistance of the model as tested in the tank without the propeller (and usually designated E. H. P.).

As indicated, the speed of advance of propeller must be known. This is so because the slip of the propeller vitally affects its power to do work.

Slip Percentage

Slip percentage is the ratio of the difference between the speed of advance of the propeller and its speed of advance as a screw through a solid. Without slip a propeller would

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advance the amount of its true pitch per revolution; if there is slip, the advance would be less.

The slip formula is therefore usually written

$$\frac{(N \times P) - (Va \times 101.33)}{N \times P}$$

where N is the number of revolutions per minute, P is the pitch of propeller in feet and Va is the speed of advance of the propeller in knots (i.e., speed of ship minus speed of wake water).

Nearly all propeller data is plotted upon this slip percentage, but this introduces us to one of the most difficult features in propeller analysis. Every propeller blade is possessed of a certain thickness and, if the face of the blade conforms to a true screw of uniform pitch, it will be found that the true pitch of the propeller, that is, the pitch at which the screw delivers no thrust, is somewhat greater than the face pitch, and the true slip for comparative purposes must be expressed as a function of this true pitch.

Taylor's and Froude's Propeller Data

In addition to the very extensive experiments on propellers carried out and made public by Admiral Taylor, Mr. R. E. Froude of England has also given us a somewhat similar series and all of Froude's propeller data is based on this true pitch of propeller. This has made it possible to express the results of the Froude propeller tests in a mathematical formula whereas Taylor's tests are simply presented as curves of performance plotted on face slip.

Each method has its own value. Taylor's method is probably more accurate for propellers similar to those tested, whereas Froude's propellers, being correlated by formula, are probably better for interpolation or extrapolation. Mr. T. B. Abell very carefully analyzed both sets of data and showed that substantially the results were the same though the general conditions of test as to size, design, location of propeller, etc., were different, and the method of tabulation differed fundamentally as stated.

In 1915 Schaffran in Germany proposed a method of setting forth the performance of individual model propellers in a manner readily applicable to full size screws.

Schaffran's Method

This method is apparently becoming a popular one and Taylor has used it in his most recent contribution for furnishing us with the still water performance data of the three screws used.

Schaffran's data uses face slip ratio as abscissæ and curves of coefficients of torque and thrust and the resulting efficiency curve are plotted thereon. Writing

Q = Torque in foot pounds.
T = Thrust in pounds.
N = Revolutions per second.
V = Speed of advance in feet per second.
P = Face pitch in feet.
D = Propeller diameter, in feet.

We have

$$C_Q = \frac{Q}{N^2 P^3 D^2}$$

$$C_T = \frac{T}{N^2 P^2 D^2}$$

$$e = \frac{T \times V}{2\pi Q N}$$

For ready application we may add

$$\text{Torque Horsepower } Q.H.P. = \frac{C_Q N^3 P^3 D^2}{87.535}$$

$$\text{and Thrust Horsepower, } T.H.P. = \frac{C_T N^2 P^2 D^2 V}{550}$$

Or more conveniently for ship problems we may use Froude's symbols:

$$R = \frac{\text{Revolutions per minute}}{100}$$

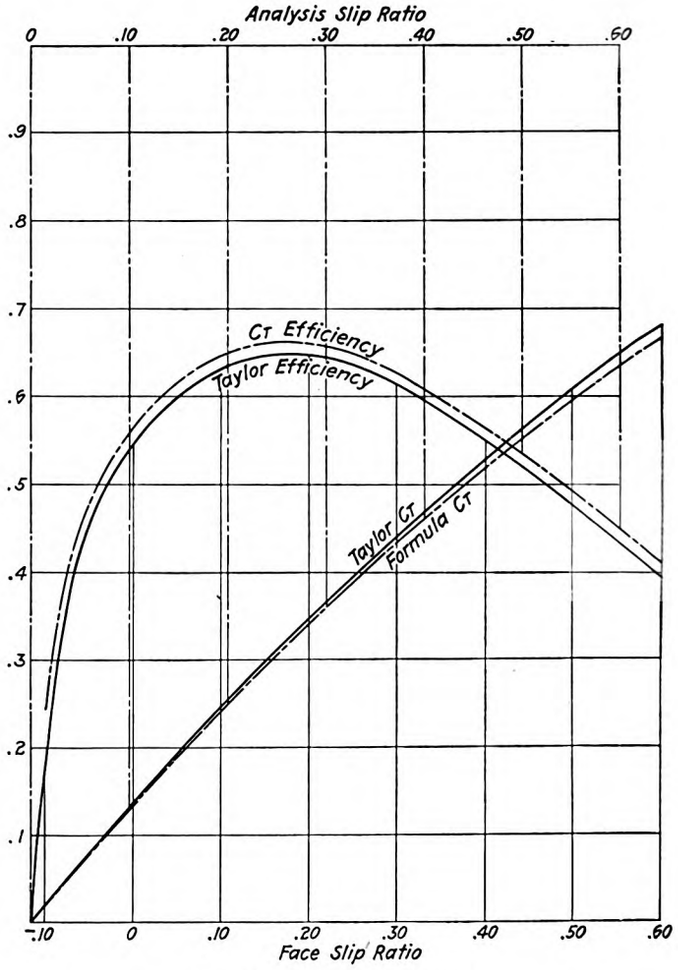
Va = Speed of advance in knots

$$\text{Then Torque Horsepower, } Q.H.P. = \frac{R^3 P^3 D^3 C_Q}{18.908}$$

$$\text{Thrust Horsepower, } T.H.P. = \frac{R^2 P^2 D^2 Va\, C_T}{117.24}$$

$$e = \frac{C_T}{C_Q} \times \frac{0.16127\, Va}{R.P.}$$

With a Schaffran diagram for a particular propeller it is very simple from trial trip results to calculate the wake



Taylor's Propeller No. 571

fraction and hull efficiency value and from these also the thrust deduction, and these elements will then be known for any new propeller for the same or a similar ship.

Taylor's paper shows that so long as the propeller is sufficiently far behind the stern post to avoid the erratic flow of the water there is no material difference in the above factors for considerable variation of diameter and pitch ratio of the screw, so that once the wake and thrust deduction are ascertained for a particular ship these may quite safely be assumed to be constant at the same ship's speed, and that at other speeds the variations are insignificant.

For vessels of other forms than that tested the paper by Professor Bragg may be referred to, and also papers by McEntee presented to the Society of Naval Architects and Marine Engineers in 1918 and 1919. From these it is pos-

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sible to plot curves of wake and thrust deduction on the vertical or longitudinal prismatic coefficients.

HOLT'S THRUST MEASUREMENTS

Mr. C. F. Holt in 1920 contributed a valuable paper to the Institution of Naval Architects (London) which gave results of actual thrust measurements made on trials of several ships, and from these he deduced that the thrust developed at sea was about 7½ percent less than the model test results for a similar propeller whereas the torque was about 7½ percent higher, giving efficiencies of about 85 percent of the model efficiencies. These figures are probably somewhat pessimistic but in the absence of other data they should be accepted and applied in the analysis of trial trip results. This would mean that C_Q should be increased 7½ percent and C_T reduced by the same amount when using propeller data with the Schaffran constants.

An example of the analysis of trial trip results is given in an appendix to this article. To utilize propeller data in the Schaffran form for design purposes it is necessary to adopt the method of trial and error. Assuming the pitch ratio, revolutions and horsepower are fixed it is required to ascertain the diameter and pitch. C_Q or C_T are of course dependent upon slip and this also is unknown until pitch is known or assumed.

$$(1-S)=\frac{Va\times 1.013}{R\times P},\ \text{therefore}\ P=\frac{Va\times 1.013}{R\times(1-S)}$$

Then assuming say three values of slip the corresponding values of pitch are calculated and, pitch ratios being fixed, the diameters are ascertained and the horsepowers may then be computed for the assumed propellers.

Curves of pitches and diameters will then be laid off on horsepowers, and the required dimensions read off for the requisite power.

APPENDIX

Trial Trip Analysis

Example: Using Holt's factors for T.H.P. = 0.925 model T.H.P. and $Q.H.P.=\frac{\text{Model Q.H.P.}}{0.925}$

Taylor's Propeller No. 571. (See Fig. 6, page 787, MARINE ENGINEERING AND SHIPPING AGE, December, 1922.) Diameter, 11 feet 9 inches; pitch, 8.45 feet; R.P.M., 125; S.H.P., 875; ship speed, 10.0; E.H.P., 438.

$$Q.H.P.=875\times 0.97=849\ \text{say}=\frac{R^3P^3D^2C_Q}{18.908\times .925}$$

$$C_Q=\frac{Q.H.P.\times 18.908\times 0.925}{1.952\times 138\times 603}=\frac{14{,}849}{162{,}434}=0.0914$$

Face slip from diagram = 0.41

$$1-S=0.59,\ Va=\frac{.59\times 1.25\times 8.45}{1.0133}=6.15\ \text{knots}$$

$$\text{Wake}=\frac{10-6.15}{10}=0.385$$

$$\text{Thrust H.P.}=\frac{C_TR^2P^2D^2\,Va\times 0.925}{117.24}=\frac{0.53\times 0.925}{117.24}\times R^2P^2D^2\times 6.15=396$$

$$\text{Hull efficiency}=\frac{E.H.P.}{T.H.P.}=\frac{438}{396}=1.106$$

$$\text{Thrust deduction}\ \therefore\ (1-t)=(1-w)\times 1.106=0.68,\ t=0.32$$

$$\text{Propeller efficiency}=\frac{396}{849}=0.466\ (\text{from diagram } 0.548\times 0.85=0.466)$$

$$\text{Propulsive coefficient}=\frac{438}{875}=0.500\ \text{using S.H.P.}\ (=0.466\ \text{on I.H.P.})$$

The Wake System of Automatic Steering

By R. H. Rogers*

A SHIP and its cargo weighing twenty thousand tons and moving twenty feet per second is reluctant to change its direction of motion, but is singularly free to yaw to port and starboard of the course being made good, as indicated by the wake. The sweep effect of the rudder is negligible hence the power to change a ship's heading, which is one thing, and to change her course, which is another, does not come from the rudder motive power, but from the stored energy of the moving mass and that necessarily at a sacrifice of its velocity.

The compass is a little slow in its warning and the helm is moved too late, too much and too often, with the result that a ship's daily run is the average of an undulating speed curve which has a dip for every helm movement. The General Electric Company has made observations and records for several years on many ships which reveal preventable losses of considerable magnitude as compared with other shipboard losses that are receiving much more attention.

The frequency and amplitude of yawing in a well trimmed ship of 12,000 tons displacement making 12½ knots in fair

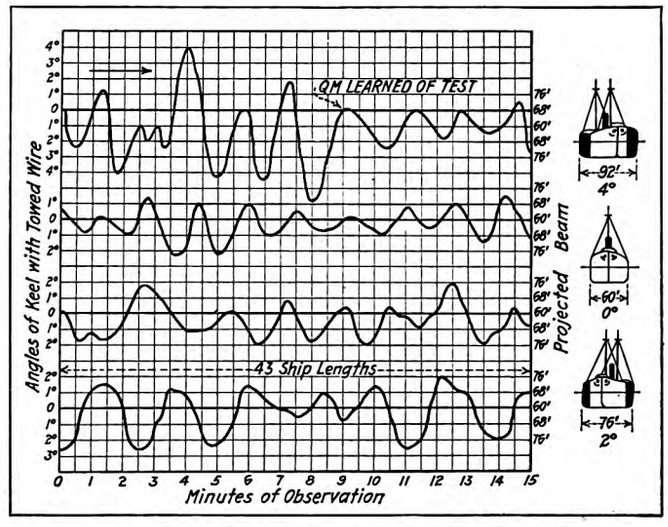

Fig. 1.—Typical Yawing Chart Made by Hand Steering

sea and weather is shown in Fig. 1. This record was on a 300 degree course steered by hand to a gyro compass through a hydraulic telemotor and an electric steering gear, all in good condition. There were 67 reversals of headings in one hour. A yawing of 6 degrees in one half minute was noted. The ship yawed 4 degrees while going one length.

To mitigate the variable losses of time and fuel and to hold the ship closely to the desired course, are the functions of automatic steering devices which must kill incipient swings before they have grown appreciably.

OPERATING PRINCIPLES OF WAKE SYSTEM

The wake system of automatic steering functions to fix the course made good, leaving the ship's heading free to prevent deviations that might be caused by wind, seas or propeller drift. The actuating member is a taut wire line from the ship to a suitable drag, towed in the wake and which is therefore exactly in line with the course being made good. The ship pivots about the inboard end of the wire, pressing one or the other of two electric switches against it. These switches control an electric telemotor which works parallel to the

*Marine Department, General Electric Company, Schenectady, N. Y.

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normal telemotor and controls the steering gear to give prompt and proportional countering helms which die out to zero as the error dies out.

The point of attachment for the wire has a small athwartship movement imparted by a mechanical connection to the rudder stock. This movement serves to allow the ship to take any heading necessary to free the switches from the wire, thus holding the direction of motion to a definite line. This lateral motion is too small to affect the direction of the long wire but it has a marked effect in the short distance

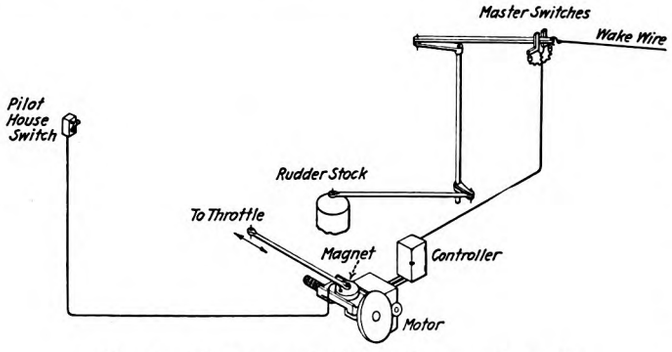

Fig. 2.—Diagram of Wake System Controls

to the switches where 1 degree of swing causes ½ inch of relative movement.

Fig. 2 shows a schematic diagram of an application to a ship. It has been demonstrated that 145 fathoms of sounding wire towing a 30 pound sounding lead makes a satisfactory combination. The tension is 150 pounds at 12½ knots, giving great rigidity against the side pressure of the switches. Rolling and pitching produce no detrimental relative movement between the wire and switches which may be adjusted for a reasonable tolerance. Fig. 2 shows the ship under very variable conditions following its predetermined course with free headings.

The practical operation of the wake automatic steerer is very simple and easily understood. The quartermaster will steer by hand on whatever heading is necessary to make good the desired course, the lee-way, if any, being indicated in degrees at the wire. When satisfied with the course, the pilot house switch is closed, thereby putting the automatic in charge. The ship will now progress in a straight line but with variable headings if the deflecting influences are variable and the navigator is no longer required to estimate corrections for drift, etc. After a time, an appreciable error may be built up which may be corrected by opening the pilot house switch to allow of hand steering again for a few moments.

The guiding principle of the towed line is very marked, its indications being instantaneous and exact, being in advance of and in excess of those shown by the compass.

British Tanker Delivered.—The *British Fusilier*, which has been built and engined by Swan, Hunter & Wigham Richardson, Ltd., at their Neptune Works, Newcastle-on-Tyne, to the order of the British Tanker Company, Ltd., of London, has completed a very successful trial trip off the Tyne, and sailed to take up her station on her owners' service. The steamer is an oil tanker, carrying over 10,000 tons of oil, and is about 455 feet in length by 57 feet beam. The propelling machinery has also been constructed by Swan, Hunter & Wigham Richardson, Ltd., at their Neptune Engine Works, Newcastle-on-Tyne, and consists of a set of turbines of the Metropolitan-Vickers Rateau type, with double reduction gearing of the three-box floating frame type, steam being supplied by three large boilers fitted with Howden's system of forced draft, and burning oil fuel on the Wallsend-Howden system. The principal engine room auxiliaries are electrically driven. On the trials a speed of 11¾ knots was attained.

Cable Steamer Dickenson Launched.—The cable supply steamer *Dickenson*, described on page 92 of our February issue, was successfully launched on February 17, at the yard of the Sun Shipbuilding Company, Chester, Pa., the sponsor being Miss Mary Dickenson, daughter of one of the former officials of the Commercial Pacific Cable Company, for whom this vessel is being built. The *Dickenson* was designed by Messrs. Cox & Stevens, who also superintended her construction, and as soon as she is completed will proceed to the Pacific Coast and take up her station at Midway Island, which will be her headquarters.

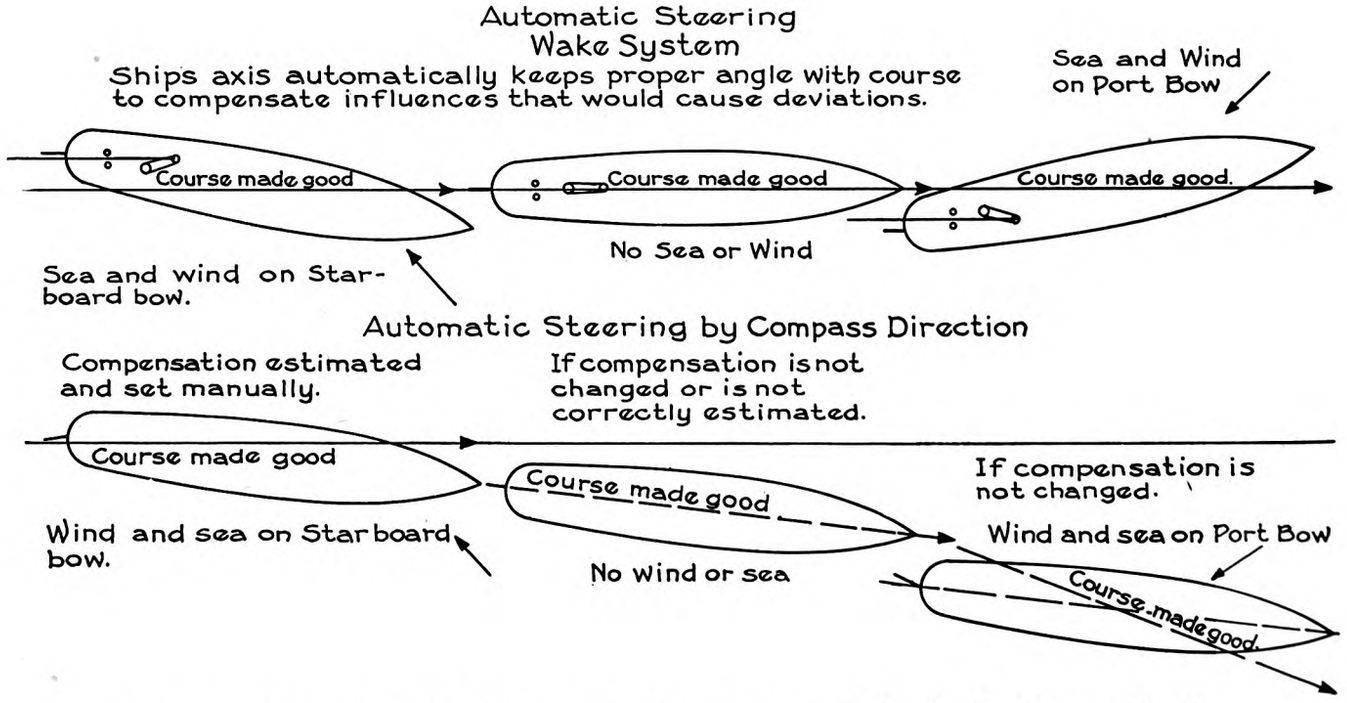
Automatic Steering
Wake System
Ships axis automatically keeps proper angle with course to compensate influences that would cause deviations.
Sea and Wind on Port Bow
Course made good
Course made good
Course made good.
No Sea or Wind
Sea and wind on Starboard bow.
Automatic Steering by Compass Direction
Compensation estimated and set manually.
If compensation is not changed or is not correctly estimated.
Course made good
Course made good
If compensation is not changed.
Wind and sea on Starboard bow.
No wind or sea
Wind and sea on Port Bow
Course made good.

Fig. 3.—Comparison of Wake System of Steering and Automatic Steering by Compass Direction

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Wood Preservatives For Shipbuilding Purposes

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials' point of view.

THIS article has to do with materials used during the construction of wooden vessels in order to guard against decay. The nature of this decay and the importance of guarding against it have been dealt with in the article by the writer on "Timbers and Lumber," in the September, 1921, issue of this magazine. The use of wood preservatives for the prevention of teredo attack will be considered under the heading of Protective Coatings for that purpose.

Good ventilation is one of the best safeguards against decay and provisions for it called for by the best practice are well worth while. On the other hand, the painting of inside surfaces of wood hulls, which is sometimes called for, retards the drying out of the wood and encourages decay.

Salt and Creosote

Probably the oldest preservative in use, and certainly the one in almost exclusive use up to comparatively recent years, is common salt. The salting of a vessel is done after the timbers to be preserved are in place in the vessel. Inaccessible spaces whose surfaces are particularly subject to decay are packed with salt, and this in most locations necessitates the fitting of boards, called salt stops, between the timbers to keep the salt in place. The salt when kept wet forms a preservative brine.

The only rival of salting whose value has been proved to date is coal-tar creosote, and this product either under its own name or some proprietary name has been extensively used during recent years. The nature of this material and its method of application may be understood from the following specifications which were adopted by the United States Shipping Board Emergency Fleet Corporation, which made this preservative the standard for its entire fleet of wood steamships and schooner barges. The specifications for the creosote oil itself were prepared by the Forest Service of the United States Department of Agriculture, which has done a great amount of research and other work on this subject. The high boiling point oil is specified to minimize the loss due to evaporation of the oil.

Creosote Oil for Brush Treating of Ship Timbers

1. The oil to be obtained from coal gas or coke-oven tar and shall be free from any tar, including coal gas tar and coke-oven tar, oil or residue obtained from petroleum or any other source. Oil to comply with the following requirements:

1. To be completely liquid at 15 degrees C.
2. To contain not more than 2 percent of water.
3. To contain not more than 0.5 percent of matter insoluble in benzol.
4. The specific gravity of the oil at 15 degrees/15.5 degrees C. shall not be less than 1.08.
5. The distillate based on water-free oil to be within the following limits:

Up to 210 degrees C. not more than 1 percent.
Up to 235 degrees C. not more than 10 percent.

6. The specific gravity of the fraction between 235 degrees C. and 315 degrees C. to be not less than 1.03 at 38 degrees/15.5 degrees C. The specific gravity of the fraction between 315 degrees C. and 355 degrees C shall not be less than 1.10 at 38 degress/15.5 degrees C.
7. The residue above 355 degrees, if it exceeds 5 percent, shall have a float-test of not more than 50 seconds at 70 degrees C.
8. The oil to yield not more than 2 percent coke residue.
9. The foregoing tests shall be made in accordance with the standard methods of the American Wood Preservers' Association.

2. Although the brush treatment is less efficient than the pressure or open tank system, it is recognized as often desirable and is used by many in the absence of more thorough methods. Unless absolutely unavoidable the timber should not be treated when it is green, wet or frozen. It should be borne in mind that by not properly carrying out the brush treatment it is an easy matter to render the treatment worthless.

3. Coal-tar creosote oil should be applied with a three or four knot rubber set or wire bound roofing brush, the oil having been heated to a temperature of 200 degrees Fahrenheit. All crevices and shakes should be filled with the oil, using the same liberally for the first coat. The second coat should not be applied until the preceding coat has been fully absorbed. It is best to apply the different coats on different days.

4. During the building of hulls all faying or joined surfaces of timbers and planks, etc., throughout will receive two coats of preservative.

In a consideration of the relative merits of the salting and creosoting methods, it can be said for salting that it is inexpensive, easy to apply regardless of temperature and weather conditions, and comparatively easy to keep in condition or renew. Its chief objection is its weight and the loss of deadweight carrying capacity thereby incurred. As its poisoning property is very low it must be used freely. It was estimated that one of the Emergency Fleet Corporation standard wood steamships would require about 90 tons of salt, if this method should be adopted. Salting also interferes with ventilation which particularly affects the spaces below the salt chocks, and it subjects iron fastenings, even when galvanized, to rapid corrosion.

The Forest Service has stated that coal-tar creosote is probably the most effective preservative which can be readily applied on ships at the time they are under construction. It has been thoroughly tried out and found to accomplish the desired results. There are proprietary preservatives made from wood tar and water gas tar which may be effective, but the writer does not know that any of them have been thoroughly proved. They have not to date been looked upon with favor by the classification societies. It is, however, claimed by one of the manufacturers of wood-tar creosote that such a creosote is much superior to the coal-tar creosote in locations where the wood is continually wet. Creosote is more difficult to apply properly, and this difficulty assumes importance when the timbers are green, wet or frozen; and the checking up of its proper application is more difficult. Workmen, except negroes, are subject to burns from it, particularly those with light complexions; but this can be guarded against by the use of vaseline. Oil paint cannot be successfully applied to creosoted surfaces and the creosote has a tendency to disintegrate oakum. It is claimed by some

*Member of the firm of Rossell & Thayer, naval architects and marine engineers, Philadelphia, Pa.

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that the odors given off by creosote damage such cargoes as flour and rice, but the amount called for to meet classification society requirements is not sufficient to cause material damage of this nature.

The classification societies strongly recommend the use of a preservative during the construction of a wood vessel and the application of a preservative according to their requirements entitles the vessel to a longer classed life. Their requirements when salting is used are pretty definitely defined in their published rules for wood ship construction; but these rules do not cover the creosoting method and in some cases a classification society may require salting in whole or in part. As has been pointed out in the article on "Timbers and Lumber" before referred to, the hardwoods contain considerably more moisture than softwoods and therefore require a longer time to season. In vessels with oak framing the timbers might be far from being seasoned when in place in the vessel, whereas the framing, if of yellow pine or Douglas fir, would in the same length of time be well seasoned. For this reason one or more of the classification societies have in some cases required salting with hardwood framing.

Details of Application

The Forest Service has presented the following old classification society rules, somewhat modified, as representative of thorough treatment when the salting preservative method is adopted:

The stops between the frames to be placed at the light waterline, and the spaces between the frames filled with salt to the planksheer. If the frame timbers are choked apart, the chocks are to be partially split out next the ceiling, and the salt admitted to stops between the timbers of each frame, at the height of the light waterline, fore and aft, and the spaces filled with salt to the gunwale. The salt between the frames should be dampened down at intervals to renew the pickle.

The stern frame, and the cant frames, forward and aft, to be salted in the same manner down to the deadwoods and as many more frames as the cants, at each end, to be salted down to the short floor-heads, stops being put in at intervals of about three feet each. The spaces over the shelf or knees to be filled with salt, at least one inch deep. Stops to be fitted to keep the salt from choking the air and water courses, wherever these interfere with continuous filling.

After the ceiling is worked, holes of the size of treenails, to be bored in the middle of the strakes, and alternately into each timber of the frame nearly to the planking, and filled with salt, wetted with pickle and plugged. Where holes are bored for through treenails, if plugs are inserted to hold the brine, the frame may be salted and pickled thoroughly, before the fastening is all driven.

The ends of beams, arms of knees, hooks, transoms, stern-post, apron, and stem, the deadwoods and keelsons to be internally salted, in the same way. Holes to be also bored through the rail into the stanchion heads, the knightheads, head of pall-post, rudder-stock, bowsprit and masts, and the overhead arches of steam vessels for the reception of salt and brine, and be plugged for convenient renewal annually. The keelson to be cased fore and aft, where single, with room of one inch on top and sides for the reception of salt. If the keelsons are double, the space between to be ceiled and calked, and the salt put between them and covered.

The deck framing to be grooved along the grain, in the middle of the beams, ledges, carlins and partners, to the depth of an inch, and the grooves filled with salt as the deck is laid. The deck to be bored over the middle of the beams and ledges, in the middle of alternate strakes, salted and brined to the depth of six inches, and the holes tightly plugged one inch deep. The planksheer to be bored over the salt spaces for renewing the salt between the timbers. All salt plugs to be removable, that the salting may be renewed annually, until no longer necessary for the preservation of the wood.

As a guide to what may be called for when creosoting is adopted, the requirements of the American Bureau of Shipping issued in 1917 for the wood ships of the Emergency Fleet Corporation are of value. They called for two coats of preservative on the surfaces of all important structural members in contact with other surfaces, but not including calking seams or butts, and on all surfaces of beam ends for 4 feet 6 inches in from the ends, and three coats of preservative on all surfaces of beams in coal bunkers. Oak treenails were required to be immersed in preservative heated to 180 degrees for at least ten minutes. Iron fastenings and spikes might be dipped in cold preservative, in lieu of grease, before driving, except where driven from surfaces which were later to receive lead and oil paint.

The coating of butts except in way of calking is particularly important, as decay is likely to begin at the butts. It is desirable to coat the exposed surfaces of all frame timbers as well as the faying surfaces; and also the frame side of the planking and ceiling. Other important surfaces are the tops of weather deck beams, contact surfaces of shelves, clamps and waterways, all contact surfaces of bulkheads and all parts of the deadwoods.

In order to be effective, the preservative should thoroughly impregnate the wood to a depth sufficient to allow for subsequent season checking, mechanical abrasion, injuries, etc. Creosoting by the pressure method is of course the best method, but this is usually not practicable for shipbuilding work. The next best method is dipping. A liberal application of hot creosote with an air spray or brush comes next in order to dipping, the air spray being probably the better of the two. With brush treatment the creosote should be flowed on, using a large brush, and not be handled like a paint. It is of little value to creosote timber before it is cut to size and shape because the subsequent cutting operations will even with the most thoroughly impregnated treatment penetrate the treatment and permit decay to start on the untreated wood thus exposed.

Creosote is much more effective when applied hot and the heating of it can be readily accomplished by the use of steam without fire risk or appreciable additional labor cost. A method of heating the creosote adopted by one shipyard was observed and reported upon by the Forest Service as follows:

A box about 2 feet wide and 10 feet long is made watertight by calking. The top is made with round holes cut into it, of the right size to receive a cone-shaped bucket. The lower part of the bucket sinks into the water, the top rim sitting over the hole, which holds the bucket in place. The box is filled with water which is heated to the boiling point by steam from a steam pipe at one end. This could also be accomplished by a steam coil, thereby saving the steam, or by a pipe running the full length of the box with jets at various intervals. Where possible, exhaust steam should be used. The wood preservative is placed in the cone-shaped buckets which, when set in the holes of the box, are immersed in the boiling water. The preservative soon heats to approximately the boiling point of water and is taken in the buckets directly to the ships, to be applied on the timbers. Before this method was in use four men in different parts of the yard at wages of 40 cents an hour were employed to heat this preservative. With this method no extra men are necessary as the men applying the preservative, on returning to the box simply refill their empty buckets, place them in the hot water, and take one filled with hot preservative. When not in use the buckets should be covered. The preservative thus is heating while the men are applying it on the ship timbers. In this manner a saving of about $17 a day was accomplished, beside keeping the preservative at a high temperature continuously, with no risk of fire.

Other Preservatives

Brazilians are said to use a preservative called "Gallagalla," composed of pitch, unslacked lime and oil, mixed to a rather stiff consistency and applied without heating. A process for treating the wood with a solution of hot ferrous sulphate followed by a solution of copper sulphate was investigated by the Forest Service, and an adverse report submitted by them. There is a poisoned paraffine process which is claimed by its inventor to provide efficient protection at a cost only slightly in excess of creosoting. There are also other processes proposed from time to time for the preservation of ship timbers from decay, but they are generally too expensive or are impracticable under shipbuilding conditions.

The National Safety Council has accepted the invitation of the Buffalo Chamber of Commerce to hold the 1923 National Safety Congress at the Statler Hotel, Buffalo, N. Y., October 1 to 5.

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Waves of the Ocean

Theory of Waves—Speed, Length and Height — Surface Tension

By C. H. Peabody, Dr. Eng.

IT is astonishing how little is known about the waves of the ocean considering that they have been known to navigators for thousands of years, more especially as the commonly accepted theory was developed by Gerstner more than a 100 years ago. To be sure the true ocean wave is found only in the open sea and scientists habitually live ashore; few seamen are scientists and those who are have something else to do than making investigations of the shifting and evanescent waves; and wave measurements are difficult and uncertain.

Trochoidal Theory of Waves

The commonly accepted theory is known as the trochoidal theory, which has the advantage that it gives fairly simple methods of calculating the properties of waves and ties in fairly well with the measurements of waves that have been made, namely of length and speed. As for the somewhat formidable name of the theory it may be sufficient to say that the trochoid is the path of a spot on a wheel as it rolls

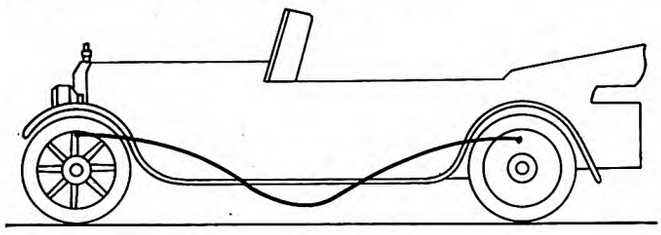

Fig. 1

along, as illustrated in Fig. 1; such a trochoid is upside down when compared with that of the wave but that need not concern us now.

If you watch a wave at sea you will see it approach the ship, underrun it and speed away in the distance; but if you watch something afloat, perhaps a bit of seaweed, you will see it move up and down with the wave but you will see that it does not move forward with the wave. A close inspection shows that it moves back and forth as well as up and down. Usually there is a slow drift in the direction of the motion of the wave, but some time is required to detect it and one is likely to assume that it is blown along by the wind; and so it undoubtedly is though there is reason to think there is a proper drift.

Trochoidal Motion

Starting with the idea that a particle of water affected by a wave moves up and down and back and forth, the easiest conception of such a motion is that the particle of water revolves round in a circle about a fixed center. That is the

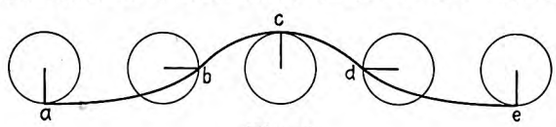

Fig. 2

fundamental idea of trochoidal motion. Thus in Fig. 2 let *a b c d e* be particles of water uniformly spaced; let *c* be at the crest of the wave and let *a* and *e* be at hollows, while *b* and *d* are on the slopes; a curve drawn through these points is a trochoid like that of Fig. 1 except that it is the other side up.

The real reason why the trochoid was shown by Gerstner for his wave theory, is that it is relatively easy mathematically; when he found that with the theory he could compute the properties of the waves and that his computations tied in with what was known or could really be determined about waves, he must have been convinced that he had found the true key to the problem.

But it is easy to show that the sea wave does not have the

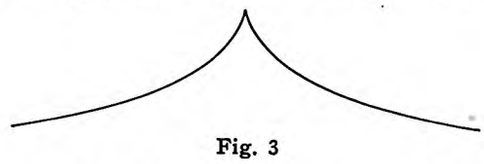

Fig. 3

form of a trochoid because the mathematical limit of that wave is found when the trochoid of Fig. 1 is made by a point on the extreme outside of the tire. Thus in Fig. 3 when the radius of the orbit of a particle of water is taken as $\frac{1}{6.283}$ of the length we have a cycloid. The trochoidal theory shows that a particle of water might revolve in such orbits as shown in Fig. 3 and that at the crest the pull of gravity would be just sufficient to keep the particle in its orbit and no more. Should the height of the wave increase ever so little the particle at the crest would fly off and the wave would break. But the most casual observation of waves at sea shows that they break at the crest long before they become so high. The cycloidal wave, should one exist, would have a height from hollow to crest of nearly a third of the length, whereas sea waves break when the height is a fifth of the length or less.

Requirements for Formation of Sea Wave

Now mathematicians have decided that while a trochoidal wave could exist, if once made, such a wave never has been or can be formed at sea. There are three things necessary for the formation of a sea wave, namely, equilibrium, continuity and irrotation. This looks like a formidable list of requirements and the equations expressing them are even more formidable to the dabbler in mathematics who knows about enough to integrate for the area of a simple figure. But the fundamental ideas can be stated simply enough.

For the trochoidal theory we have assumed that each particle of water revolves uniformly in a circular orbit; the forces acting on it are in equilibrium as are those acting on a planet; the earth swings round securely forever in its orbit. A similar, though perhaps a more complicated, condition is required for any wave motion.

The condition of continuity is almost ridiculous in its simplicity; there must not be any holes in the water; a lot of bubbles for example.

The third condition requires a little more explanation. Consider the crank of an automobile; if the handle is a solid piece of steel it will turn in the hand, and the motion of the handle in its orbit will be rotational; but if there is a loose wooden handle it will not turn in the hand, and the same side will always be on the top, and so its motion is irrotational. The only test for rotation of the water in a trochoidal wave is that the equations for the wave do not conform to the tests applied by the mathematician; as

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we are not going to develop those equations nor explain the test we will have to let it go at that. But this we will say that the only forces acting on the water in a wave are pressure and gravity, and the mathematician readily shows that those forces cannot produce rotation. If, then, there can be no rotation to a sea wave, the trochoidal wave with rotation is not the true sea wave. Q.E.D.

There are one or two little matters which have been left out all along, like viscosity of the water and surface tension or, as it is sometimes called, capillarity. It is easy to show mathematically that these influences have no appreciable effect on sea waves which commonly are three hundred feet long and sometimes are a thousand feet long.

Irrotational Wave Theory

By the application of the methods of hydrodynamics, Sir G. Stokes has developed the theory of an irrotational wave which has two items of interest for us; one is that the form of the wave at the limit when the crest begins to break is reasonably like that of the great sea combers; the other one is that his theory gives forms for long gentle swells that approach near to those of the trochoidal wave. The last item is very important for it indicates that for waves that

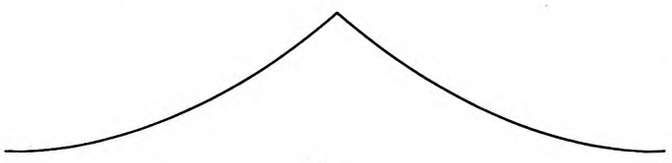

Fig. 4

do not approach the limit of breaking, we may use the methods of computation developed for the trochoidal wave.

The form of Stokes' wave at the limit is shown by Fig. 4, taken from the writer's "Naval Architecture;" so far as is known that is the only correct representation of Stokes' wave extant. The most notable thing about the contour of the wave as shown in Fig. 4 is the roof shape of the crest; the angle at the peak is 120 degrees and that is shown by Stokes to be a necessary condition for an irrotational wave. Even casual observation of sea waves which have a tendency to break at the crest will show that they have this characteristic.

It has already been said that a rotational wave like the trochoidal wave (which conforms by the way to the requirements of equilibrium and continuity) is discarded by the mathematicians because there is no natural cause to make rotation. Curiously enough attempts to make artificial trochoidal waves do not come out any better. When R. E. Froude wanted a trochoidal wave in the Admiralty experimental tank and set up a proper apparatus for that purpose, he did not get it, but got a wave similar to the Stokes wave as he kindly showed the writer when he visited that tank.

One more feature of the Stokes' wave will be mentioned and then we will drop it as it is not conveniently computed for ordinary use; this feature is that his wave is shown mathematically to have a slow drift of the water in the direction in which the wave runs. Another mathematical form possible for irrotational waves is proposed by Michell; its notable feature is that the theory shows that the crest will break when the height is one-seventh of the length. It also approaches the form of the trochoidal wave when the height is small.

Relation of Speed and Length

The most interesting property that can be computed by aid of the trochoidal theory is the relation of speed and length; without going into details of the theory or its application for this purpose we will give the results in the following table:

Length, Time and Speed of Waves

Length, feet	Time, seconds	Speed, feet per second	Speed in knots
50	3.10	16.0	9.5
100	4.40	22.7	13.4
200	6.20	32.0	19.0
400	8.80	45.3	26.8
600	10.80	55.0	32.8
800	12.50	64.1	37.9
1,000	14.00	71.6	42.4
2,000	19.8	101.5	60.0

It may be interesting to note that the open ocean wave is about 400 feet long and has a speed of 26.8 knots, a speed attained by a few classes of ships such as express passenger steamers, battle cruisers and destroyers; a thousand-foot wave has the speed of an express train and a 2,000-foot wave is twice as fast as anything that floats.

The measurements of the time and length of waves can be made without special apparatus and require but little practice; unfortunately conditions for good results are likely to interfere with the proper navigation of the ship, which is the reason such measurements are so seldom undertaken.

How to Measure Length and Time of Waves

When a ship is steaming directly across the waves, a life buoy may be run out on a log line, which has marks at every 50.7 feet. By trial the length of the line may be adjusted so that the buoy shall be on the crest of a wave astern at the time when there is a crest directly under the observer.

For measuring time it is most convenient to stop the engine and wait till the ship has lost way, and then note the time between successive crests. If, however, it is desired to take observations while the ship is steaming slowly against the waves an allowance must be made for the speed of the ship. Suppose that the ship is steaming ten knots an hour, then since there are 6,080 feet in a knot the speed in feet per second will be:

$$10(6{,}080 \div 3{,}600) = 10 \times 1.69 = 16.9 \text{ feet per second.}$$

If the observed time from one wave to the next wave is 6.4 seconds the ship will have run forward

$$6.4 \times 16.9 = 108 \text{ feet}$$

during the time of the observation. If the observed length of the wave is 400 feet it is clear that the crest will have run only

$$400 - 108 = 292 \text{ feet.}$$

Consequently a simple proportion will give for the time required to run 400 feet

$$292{:}400 :: 6.4{:}\ t_w, \text{ therefore } t_w = 8.8 \text{ seconds.}$$

Height of Waves

There is nothing more illusive than the apparent height of waves, especially when the ship is rolling and the waves are high and threatening. No apparatus is necessary and there is no need to change the course or speed of the ship; all deck officers are advised to acquire some facility in estimating wave heights. The observer must find by trial some position at a proper height, such that he can just see the horizon over the crest of the nearest wave when the ship is erect in a hollow. The distance from his eye to the water is the height of the wave from hollow to crest. Patience and adroitness will be required by the observer to get a combination of the conditions so briefly stated above; and it may be difficult to find a proper location on ships with lofty decks now in common service. Wave heights are seldom more than five percent of the length; so that a 400 foot wave would be 20 feet high.

Effect of Depth of Water on Waves

Any acceptable wave theory must indicate that the wave disturbance dies out downward and agree with the observa-

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tion that there is little or no disturbance in deep water. The trochoidal theory gives the following table:

Decrease of Wave Disturbance with Depth

Ratio of depth to length	Ratio of orbits of particles
0.01	0.94
0.02	0.88
0.03	0.83
0.04	0.78
0.05	0.73
0.1	0.53
0.2	0.28
0.3	0.15
0.5	0.043
1.0	0.0019
2.0	0.0000035

It will be noted that at a depth equal to one-tenth of the length the disturbance is only half that at the surface; a 400-foot wave may have a height of 20 feet at the surface but at a depth of 40 feet below the surface the disturbance is only 10 feet. At a depth equal to half the wave length the disturbance is reduced to four percent that at the surface. Our 400-foot wave with a height of 20 feet will have a disturbance of only five inches at a depth of 200 feet. This is the rational of the rule that the depth of water proper for speed trials of a ship is half the corresponding wave length. Thus a ship with a speed of 26.8 knots will be accompanied by waves 400 feet long and should not be tried in less than 200 feet of water. More extended observations of speed trial conditions show that this rule is likely to give greater depth than necessary for fast ships like torpedo boats and destroyers and not enough for large ships with deep draft.

ENERGY IN WAVES

Viewing waves either from the shore or from the deck of a ship at sea one is impressed by the limitless store of energy running to waste. The theory of trochoidal waves gives a simple approximate equation for energy

$$E = \tfrac{1}{8} w L h^2$$

where w is the weight of a cubic foot of water (64 pounds for sea water) L is the length from crest to crest in feet and h is the height of the wave also in feet; this gives the energy of a strip of water one foot wide and L feet long; the depth is not limited but it has already been shown that a wave dies out rapidly downward so that the energy is relatively near the surface, say half a wave length deep. For a wave 400 feet long and 20 feet high the equation gives

$$E = \tfrac{1}{8} \times 64 \times 400 \times 20^2 = 1{,}280{,}000 \text{ foot pounds.}$$

Were there any way of harvesting the energy of the sea there would be no occasion to worry over coal supply. But at present there seems better prospect of harvesting the sunbeams of the desert of Sahara.

EFFECT OF SURFACE TENSION

So far we have been dealing with large waves which are not affected by surface tension or capillarity. Our present interest is that surface tension interferes if we try to make observations on small waves either in the laboratory or on open water, observations which are attractive and relatively easy but which give incorrect impressions, if our results are applied to large waves. If the waves are small enough their characteristics are controlled entirely by surface tension, gravity having no appreciable effect. To show that the characteristics are different from those of large waves it is enough to say that the shorter such waves are the faster they go. This is exhibited in the following table which is in inches and seconds.

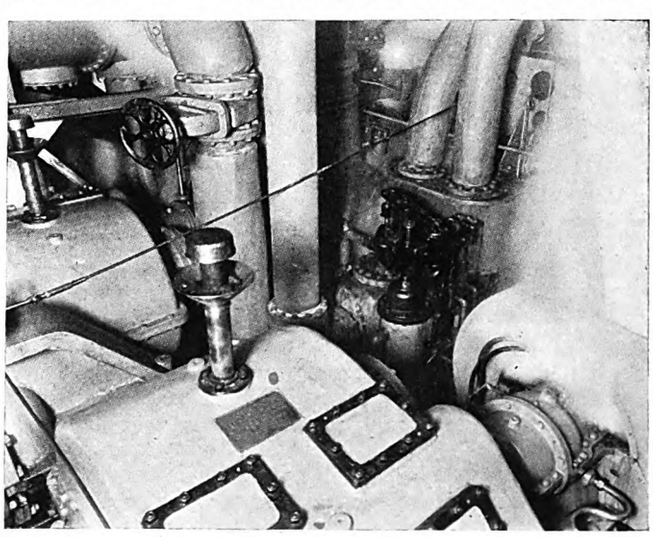
Wave length	Speed	Frequency
0.20	12	61
0.04	27	680
0.02	38	1,930

Since large waves increase in speed as they grow longer while surface tension waves decrease in speed, there must be some minimum speed for little waves, little enough to feel the effect of both surface tension and gravity. The theory shows that such a wave would be 0.68 inch long and that it would have a speed of 0.76 feet per second or 0.45 of a sea mile per hour. This result agrees with an observation by Scott Russell that a wind with a velocity of half a mile an hour can start a ripple on the surface of still water; this ripple soon disappears if the wind dies down. The same observer says that true waves appear when the wind has a velocity of two miles an hour, which is the speed of trochoidal waves 2.2 feet long.

The writer once tried to determine how long ship's models for the towing tank should be to avoid capillary interference with wave formation in the wake of the model. Assuming that such effect should be less than one percent, the minimum speed of the model was computed to be 0.78 knot. Now models are tested at what corresponds to full speed and at fractions of that speed. If we assume that a model may be tested at quarter speed, then the full model speed should not be less than three knots. The law of similarity shows that, if a model of the ship is 12 feet long and the ship is 588 feet long, the full speeds of the ship and the model will be twenty-one and three knots respectively. This falls in with customary practice. The size of models is determined by other matters, such as convenience in measuring and recording results in the model towing basins. At the Washington model basin and at one or two others models twenty feet long have been used; at the greater number of experimental stations the models have been about twelve feet long and this is probably the minimum length for best practical results.

Turbine Governor Enables S. S. Mount Carroll to Maintain Speed in Record-Breaking Storm

DURING the very severe storms that swept the Atlantic during the early part of January of this year, many vessels, embarrassed by racing propellers, were compelled to proceed at reduced speeds; but the S. S. *Mount Carroll* of the United American Lines was able to maintain her regular 13 knots through the worst of the blow and had the pleasure of passing many liners that under ordinary



Operating Mechanism of Oil-Type Governor Mounted at Rear of Maneuvering-Valve Chest

(*Continued on page* 183)

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Strength of Column-Supported Foundations

Analysis of Stresses in Various Parts of Condenser Foundation, Assuming Maximum Inclination of Ship

By John Flodin

TO illustrate the principles underlying the strength calculations for high, column-supported foundations, the condenser foundations shown in Fig. 1 will be considered. This construction is worthy of particular attention partly because of the height of the structure, which is due to the necessity of placing other auxiliary machinery below the condensers, and partly because of the size of the condensers, it being estimated that the wet weight of each condenser plus one-half of the weight of the connecting exhaust trunk equals 124,000 pounds.

It is not the object here to attempt an exact determination of the loads on the foundations due to the above weight, but rather to analyze the stresses in the various parts of the foundation structure, assuming that the loads have been determined with a satisfactory degree of accuracy. For our purposes we may, then, omit all dynamic considerations and as a rough but safe approximation assume a maximum inclination of the ship, both in the transverse and in the fore-and-aft direction, of 90 degrees. The error thus introduced may readily be compensated for by allowing a correspondingly large fiber stress, say about 17,000 pounds per square inch.

Stress Analysis

When the ship is in the upright position the columns will act in compression, if they are "short"; otherwise the bending stresses they are subjected to may be calculated in the ordinary manner by means of any of the well-known formulæ. In this connection it should be noted that the centers of the condensers are not vertically above the centers of the foundations, so that the distribution of the loads on the frames forming the ends and sides of the foundations is inversely proportional to the distances of the horizontal projection of the center of gravity of each condenser from the frames supporting that condenser, which also applies when the ship is inclined. These partial loads, designated R in the following, are indicated in Fig. 1 together with the distances from the projections of the centers of the condensers to the sectional centers of gravity of the foundation frames. For estimating column loads when the ship is in the upright

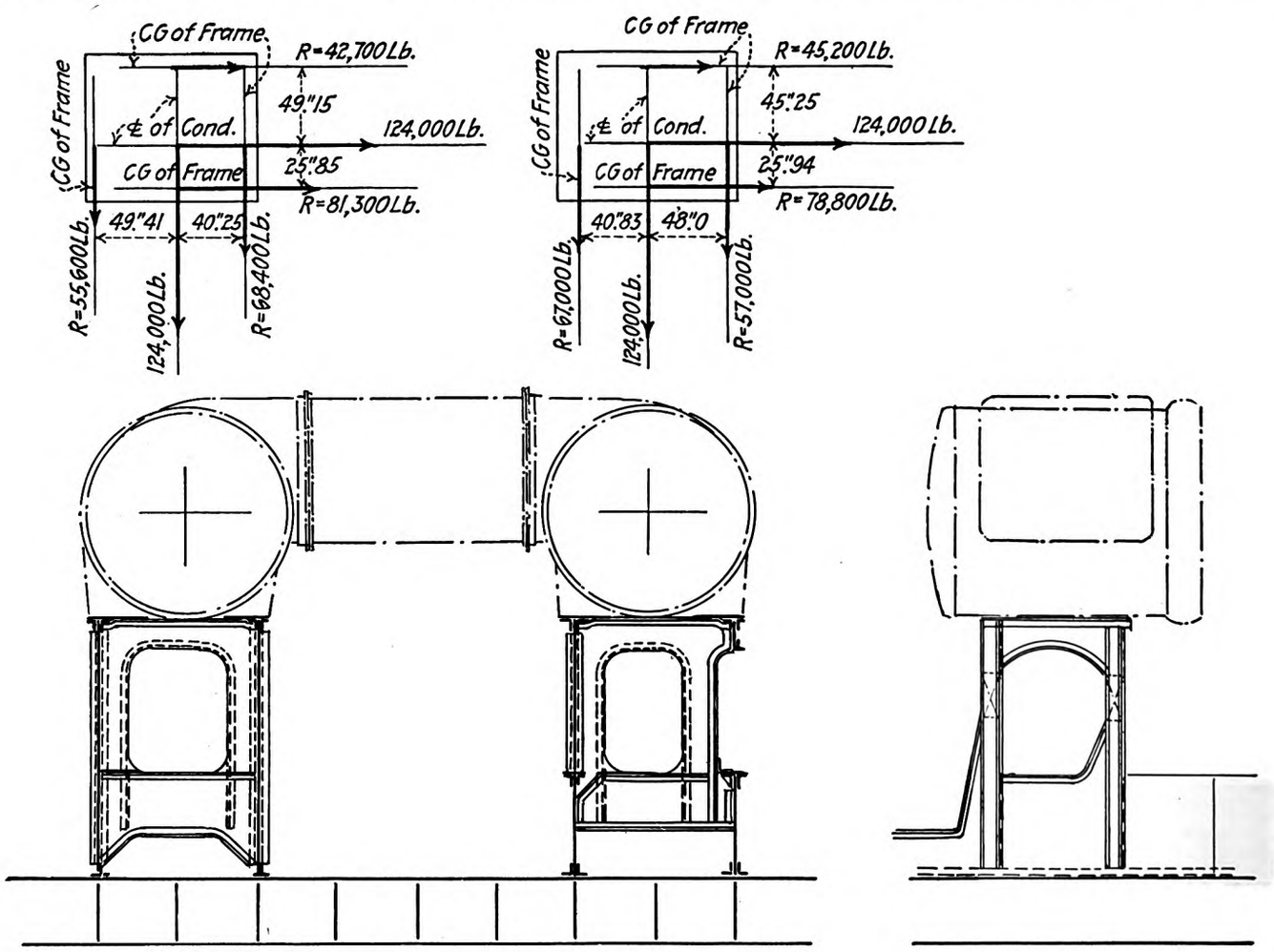

Fig. 1

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position, this breaking-up process must, of course, be carried one step further.

When the ship is inclined, each frame (i.e., two columns and their connecting overhead girder) may now be regarded independently of the rest of the structure and the stresses analyzed. From Fig. 2 we see at once that there is direct shear in the columns, but since this stress may be found in the ordinary manner no attention will be given to it here. It will also be seen that a tipping moment LR is set up, tending to tear the foundation away from the ship's structure, and that a further moment $L'R$ causes tension in the upper column in Fig. 2 and compression in the lower column. The former moment we shall neglect in this discussion since it is external to the foundation itself, but the latter moment, $L'R$, introduces stresses within the foundation, which are not negligible. This moment is resisted by the moment Fd, where F is the tension or compression in the column and d is the distance between the sectional centers of gravity of the columns. We may then write

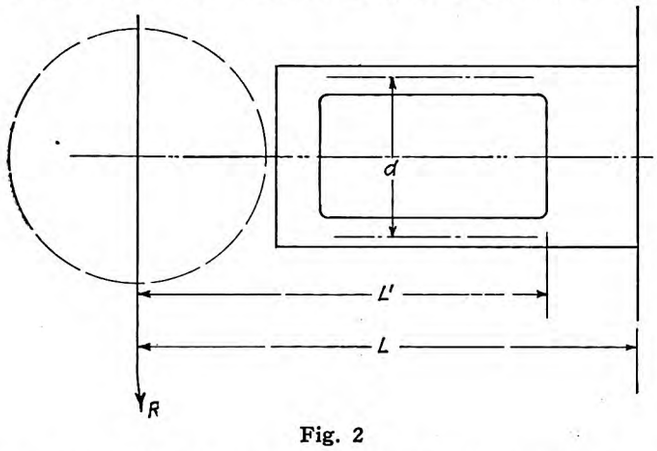

Fig. 2

$$F = \frac{L'R}{d} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

This is not, however, the total stress in either column, since each frame acts as a cantilever as indicated by full lines in Fig. 3. If the upper or free ends of the two columns are rigidly connected by means of a girder, those ends are bound to move together, and to move in such a manner that they will always remain parallel to their initial positions. We have, in other words, a case of cantilevers with constraint which resembles very closely the condition often found in bridge portals under wind load. Retaining the condition that the free ends of the cantilevers must deflect so as to remain parallel to the initial position, we may, for convenience, discard the connecting girder and say that each cantilever (or column) carries such a part P of the total load R on the foundation frame, that both cantilevers deflect an equal amount. Either cantilever is then represented by Fig. 4, where l is the free length. The bending moment of this cantilever is zero at the point of contraflexure (i.e., at the half-length, if the column is of uniform section) and is maximum at either end, where

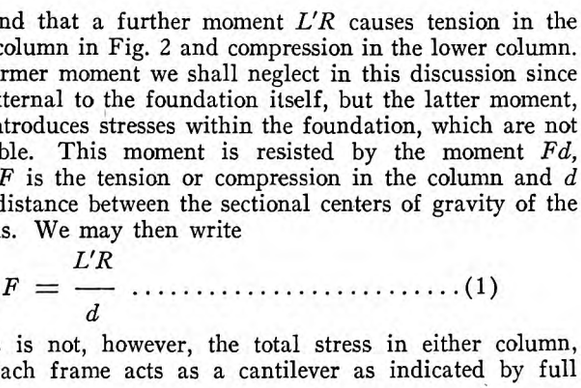

Fig. 4

$$M = \frac{1}{2} Pl \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)*$$

The total fiber stress in any column may now be found by combining the results from formulæ (2) and (3), both quantities being expressed in pounds per square inch. In lieu of the rather cumbersome process of combining direct tension or direct compression with the tension or compression due to bending, sums obtained by simple addition may be accepted as sufficiently accurate except where the sum of the compressive stresses approaches the maximum allowable unit stress to within, say, 5 percent.

Obviously we are justified in considering the columns as cantilevers with constraint only in case the conditions of rigidity at the bases of the columns and at the connections to the overhead girders are satisfied, and provided the overhead girder is rigid enough to prevent appreciable deflection of the kind shown by dot-and-dash lines in Fig. 3. The first two of these requirements are taken care of by filleting corners or by taking the free lengths of the columns as extending well into the brackets, as conditions may dictate; but the last named prerequisite for the use of formula (2) requires more careful consideration since it means that bending stresses are set up in the horizontal overhead girder.

The magnitude of these stresses may be determined from the following: As indicated in Fig. 3, points of contraflexure occur at the mid-length of the columns, while the bending moment at the ends of the columns is $\frac{1}{2} Pl$, which is the moment formula for a free-ended cantilever of one-half the length of the cantilever with constraint. This means that we may regard the columns as cut at the points of contraflexure and apply the loads P at the free ends thus obtained, without changing the values of the moments. It is now readily seen that the bending moment in the overhead girder becomes

$$M' = \frac{1}{2} Pl' \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

where l' is the distance from the point of contra-flexure in the column to the sectional center of gravity of the overhead girder, as shown in Fig. 3. It must be borne in mind, however, that if the columns of any one foundation frame are not of equal section, the magnitude of P will vary in direct proportion to the section moduli of the columns, and the larger value for P must, of course, be used in finding the bending moment in the girder for that frame.

It is not desired to give the impression that these bending formulæ will give satisfactory results regardless of the relative sizes of the columns. It is quite conceivable that, for example, the upper column in Fig. 3 might be so light that it would fail in tension while the lower column deflected as

*See Merriman, Mechanics of Materials, Article 65, page 163, 10th Edition.

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a free-ended cantilever and the overhead girder remained straight. In such a case the bending moment in the overhead girder may be expressed by $M' = F'd$, where M' is the moment found from (3) and d is the distance between centers of columns. Then $F' = M'/d =$ the tension the upper column must sustain in order to cause the overhead girder to deflect so that the lower column may act as a cantilever with constraint. From this consideration it is seen that formula (2) becomes inapplicable, if there is too great variation in the section moduli of the four columns of either foundation, unless the fiber stresses are kept correspondingly low.

The Duties of a Marine Superintendent

The marine superintendent of a steamship company is looked upon by many as an individual who has been able, by some means, to obtain one of the most desirable positions in the gift of a ship operating company. A general idea prevails that he looks after the upkeep of the company's fleet but the details of just what he is supposed to do are not so generally known. The following is a brief outline of some of his duties as directly affecting the operation of a ship.

THE principal responsibility of the marine superintendent of a steamship company is to keep the company's vessels in fit condition to meet their schedules and this keeps him continually moving in a maze of arrival dates, discharge dates, cargo cancellation dates, dates on loading berth and sailing dates. All repairs and alterations required must be arranged and undertaken so as not to interfere with the above dates.

This is a problem at all times as it is natural to endeavor to start loading as soon after discharge as possible. Hold repairs are, therefore, always urgent, the time allowed being limited, if possible, to the time necessary to clean the holds before again loading. In the case of engine room repairs there is more time but even here it is desirable to complete all work, or the major part of it, a couple of days before sailing in order to try out the machinery and have time to undertake contingencies that may develop.

Every job is therefore a rush job and, as excuses will not avail, should delay of the ship occur through uncompleted repairs, the marine superintendent must be forever in touch with his work to guard against those undertaking the repairs falling down on their completion dates.

Vessel Is Inspected Promptly Upon Arrival

Upon the arrival of a ship the first thing done is to visit the vessel and look it over so far as possible (the holds naturally will be inaccessible) and determine the repairs necessary to maintain the vessel in proper operating condition. To assist in this and to save time, the captain and chief engineer should have repair lists ready that were prepared on the trip. These lists are of great value, if carefully prepared, and can be made the means of saving a great deal of time.

Contracts are then prepared and let for such work as is deemed necessary by the marine superintendent, the awards being made after consideration of bids submitted and the ability of the contractor to meet the completion dates required as determined by experience gained from previous work.

While the placing in hand and supervision of repairs during a vessel's stay in port are sufficient to keep the marine superintendent hustling, there are other duties which he must watch out for and which are liable to delay the vessel, if overlooked. Some of these are as follows:

Periodical Dry Docking of the Vessels

In order to obtain efficient operation of the vessel and conserve fuel it is customary to dry dock a passenger ship about every six months and a cargo ship about every eight months for routine examination of bottom, painting and overhauling of sea valves. In this connection he must also be sure to notify the United States Local Steamboat Inspectors, as the law requires that such notification be made whenever a ship is placed on dry dock for repairs.

The United States Steamboat Inspection and the American Bureau of Shipping requirements are that tail shafts be drawn for examination every three years in the case of shafts fitted with solid liners and every two years where two short liners are fitted. The classification society and local inspectors are very prompt in following up the drawing of tail shafts and, unless a careful check is kept on these, an operator will be very likely to have his ship denied clearance until it has been dry docked and the tail shaft drawn for examination.

It is not always possible or necessary for a United States local inspector to attend every dry docking of a ship because of the irregular times at which dockings are made and the limited staff in the local office. The requirements of the law must be met, however, and the inspectors notified so that the dry docking will be covered, if the local office deems it necessary.

The same applies in the case of tail shafts. An earnest endeavor is made by the inspectors to cover each drawing of a tail shaft but an inspector has not the time to stand around several hours waiting for a shaft to be drawn and an operator cannot be expected reasonably to hold a ship on dry dock, with the tail shaft out, until an inspector can get there to examine it. The local office requires that a report be submitted, however, in all cases where a tail shaft has been drawn and an examination not made by a United States inspector.

This report must state the time and place of drawing and the condition of the shaft. In making this report, the marine superintendent has two alternatives. He may secure a certificate from the American Bureau of Shipping giving the report of their inspector (the American Bureau maintains resident or district inspectors so that it is possible for them to cover all cases) or he may secure an affidavit stating the condition of the shaft from the chief engineer of the vessel.

Either of the foregoing are acceptable to the United States local inspectors.

Annual Inspection

The laws of the United States require that all vessels under the jurisdiction of the United States Steamboat Inspection Service be inspected annually and no vessel will be cleared from any port unless it has on board an unexpired certificate of inspection (except in a special case where a vessel whose certificate has expired is permitted to sail to another port for repairs, in which event, however, no passengers or freight are permitted to be carried en route).

It is therefore incumbent that the marine superintendent

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keep informed at all times regarding the expiration dates of his ships' certificates and make arrangements for putting them through their annual inspections in time to allow for making such repairs as may be required by the United States local inspectors in time to secure new certificates before their scheduled sailing dates.

RE-CLASSIFICATION SURVEYS

Another date that must be kept in mind is the date the re-classification surveys required by the American Bureau of Shipping are due. These surveys are due at intervals of four years and must be carried out, if the vessel is to be retained in her class.

On account of the amount of work involved and in order to interfere as little as possible with the sailing schedule of the vessel, the American Bureau of Shipping allows one year for the carrying out of this survey.

It is in the interest of the owner, however, for the marine superintendent to put the vessel through her re-class survey as quickly as possible after it becomes due.

The following is a brief outline of the work necessary to put a vessel through a re-class survey:

DECK

1. Ship to be dry docked.
2. Bottom to be cleaned for examination.
3. Bottom to be painted with coat of anti-corrosive, one coat of anti-fouling.
4. Rudder to be lifted for examination of pintles and gudgeons.
5. The holds, between decks, peaks, bilges and the surface of the framing and plating to be cleaned, and also engine and boiler spaces and bunkers to be cleaned out.
6. Platform plates in engine and boiler room to be lifted.
7. In the holds, and bunkers, one strake of sheathing to be removed and strake of ceiling fore and aft and all portable hatches to be lifted.
8. Double bottom tanks to be thoroughly cleaned out, all ceilings to be lifted from tank tops, tanks to be tested with water pressure to the height of load line. Tank tops to be cleaned and coated with approved material and all ceilings re-laid.
9. Deep tanks, peaks, fresh water tanks and oil fuel tanks which form part of the structure of the vessel to be cleaned out and have water test of eight (8) feet above tank or the load line.
10. A steel plate one-half (½) inch thick to be fitted below sounding pipe so that rod will strike on it.
11. All parts of steering arrangement together with the blocks, rods or other transmission gear all to be opened up for examination.
12. Windlass and hand deck pumps to be stripped and opened up.
13. The sluice and watertight doors freed up and put in good working order.

    NOTE: In oil tank vessels: All tanks cleaned and proven freed of gas. Each compartment and cofferdam to be tested with a head of water up to the top of the expansion trunk hatchways.

ENGINE

14. Tail shaft to be drawn. (Get record of last drawing.)
15. All cylinders, or turbines, pistons, valves, pumps, condenser, thrust blocks, main and tunnel bearings, shafting, evaporators and steam steering gear to be opened up for examination.
16. All valves on all manifolds running to double bottoms and bilges to be opened up for examinations, spindles, valves and seats left exposed.
17. All boilers and superheaters and all valves and mountings on all boilers to be opened up for examination, leaving valves, spindles, seats and springs exposed, which includes main and auxiliary stops, gage glass stops, test cocks, whistle stops, surface and bottom blows, safety valves, main and auxiliary feed checks and stops.
18. All main steam pipes, if of copper, to be annealed and tested by hydraulic pressure.
19. After examination all parts of whatever description that are passed by surveyor to be closed in good order as before.

The foregoing may be divided over several turn-arounds in which case the marine superintendent must keep in touch with the outstanding items to be put in hand on the vessel's return.

GRAIN FITTINGS

In all cases where a vessel is fitted for the carriage of grain it is necessary that a certificate approving the grain fittings be obtained from the Board of Underwriters. A clause is usually inserted in the grain fitting contract requiring the contractor installing the fittings to secure this certificate and deliver it to the ship.

Failure to obtain such a certificate is apt to delay a vessel's departure and is also likely to cause additional outlay of money, if a vessel is fitted for the carriage of grain in one port and proceeds to another port to load. Such a case recently came to the attention of the writer where a vessel was fitted for grain in a United States port and proceeded to Canada to load. Due to failure to obtain a certificate from the Board of Underwriters in the port where the grain fittings were installed the Canadian Underwriters (who would have recognized such a certificate had it been on board) demanded changes and additional work which equaled the cost of the original installation.

UNITED STATES SALVAGE ASSOCIATION

A comparatively new association which came into being during the World War, and which is assuming a position of importance in marine circles, is the United States Salvage Association. This association is covering a large number of vessels under American registry (all Shipping Board vessels are subject to their surveys), the principal object being to conduct inspections and make reports relative to the cargo carrying condition of a vessel.

Inasmuch as the Board of Underwriters accepts the reports of the United States Salvage Association and a favorable report is reflected in a reduction in insurance rates, it behooves a marine superintendent in charge of a ship subject to these inspections to see that any recommendations made are carried out.

CONCLUSION

In conclusion let it be noted that the position of a marine superintendent is one that requires the experience of an "old timer" in the marine game.

The men usually appointed to this work are former masters or chief engineers who have been thoroughly initiated into the mysteries of ship operation. That even such experienced men will have no time for non-essential work will be apparent from the foregoing outline of some of their more important duties.

Turbine Governor Enables S. S. Mount Carroll to Maintain Speed

(*Continued from page* 179)

circumstances could outdistance her. J. P. Stafford, chief engineer of the *Mount Carroll,* states that his hand-picked engine-room crew was chiefly responsible for this performance, but he also gives great credit to the governor, with which the *Mount Carroll's* Westinghouse turbine is equipped, because it kept the propellers at practically constant speed regardless of whether they were in the water or out of it.

This governor is of a new type which automatically keeps the turbines from racing when the vessel is light or when the screws come out of the water. The mechanism is not operated by steam in the usual manner, since deposits of dirt from the steam sometimes interfere with the extreme reliability of operation that is essential for a governor. Instead, oil under pressure, derived from the lubricating supply of the turbine, which is necessarily always available, is used; and the controlling pressure is maintained by a small centrifugal pump mounted on the turbine shaft. By this arrangement, the variations in the turbine speed vary the oil pressure directly and instantly.

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Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Boiler Requirements for Marine Engine

Q. (1186).—I have a letter from a company selling boilers, and they estimate my requirement to be 1,000 pounds steam per hour for a small marine engine. How do they know that the engine will require that amount of steam per hour, and what do they mean by 1,000 pounds per hour without giving boiler pressure?—Engineer.

A. (1186).—Unless the company was given such information relative to the engine to be served as indicated horsepower or dimensions, revolutions per minute and steam chest pressure, there seems to be no way of determining the amount of steam required. In the former case the pounds of steam per indicated horsepower per hour might have been assumed and then multiplied by the indicated horsepower. In the latter case the indicated horsepower might have been worked out from the dimensions and again the pounds of steam assumed and multiplied by the estimated indicated horsepower.

Mechanical Efficiency of a Two-Cycle Oil Engine

Q. (1189).—Please tell me what would be the probable efficiency of a Beardmore engine, two cycle, 200 brake horsepower, 300 revolutions per minute, marine engine with seperate compressor. Would the efficiency be between 68 and 73 percent or would it be higher? V. C.

A. (1189).—The mechanical efficiency of the engine to which you refer would be, from the information given, about 70 percent.

Diameter of Engine Shaft

Q. (1191).—What size shaft should be installed for a 100 horsepower triple expansion engine, turning about 220 revolutions per minute?

A. (1191).—As the data given are insufficient for determining the crank shaft diameter, certain values have been assumed, where lacking, in order to solve the problem.

D = diameter of shaft in inches.
F = maximum turning force.
M = bending moment in inch pounds.
$R.\ P.\ M.$ = revolutions per minute = 220.
T = maximum twisting moment in inch pounds.
T_1 = equivalent twisting moment in inch pounds.
f = maximum allowed stress in pounds per square inch = 5,500.
r = radius of crank in inches = 4 inches assumed.
$I.\ H.\ P.$ = indicated horsepower = 100.
k = a constant depending upon the number and arrangement of cranks = 1.32 (for three crank, triple expansion engines).
L = distance between bearings + a certain distance inside the bearing, assumed as 7 inches + (2 × ¼ inch) = 7½ inches.

$$T = \frac{\text{I. H. P.} \times k \times 63{,}024}{\text{R. P. M.}} = \frac{100 \times 1.32 \times 63{,}024}{220} = 37{,}810$$

$$F = \frac{T}{r} = \frac{37{,}810}{4} = 9{,}453.$$

$$M = \frac{F \times L}{8} = \frac{9{,}453 \times 7.5}{8} = 8{,}862$$

$$T_1 = M + \sqrt{M^2 + T^2} = 8{,}862 + \sqrt{(8{,}862)^2 + (37{,}810)^2} = 47{,}678$$

$$D = \sqrt[3]{\frac{5.1 \times T_1}{f}} = \sqrt[3]{\frac{5.1 \times 47{,}687}{5{,}500}} = 3.54 \text{ or } 3\tfrac{1}{2} \text{ inches.}$$

Piston Clearance—Engine Power Ratings

Q. (1191).—(1) What allowance should be made for clearance in piston and cylinder diameters?
(2) What is the relation between the power ratings of steam reciprocating and oil engines?

A. (1191).—(1) The following differences between the diameter of a piston and the bore of a cylinder have been found satisfactory where solid or plug pistons have been used:

inches	Allowance, inches
To 4	0.002
To 8	0.003
To 12	0.006
To 16	0.008
To 24	0.011
To 28	0.012
To 34	0.015

(2) Oil and gas engine powers are based upon the power delivered by the shaft, known as brake horsepower while steam reciprocating engines are rated upon the power developed in the cylinders or indicated horsepower. The mechanical efficiency of the average reciprocating engine is about 92 percent; therefore, to put the two engines upon the same basis the oil engine would be developing 150 brake horsepower while the steam engine would have an output of 150 × 0.92 = 138 brake horsepower.

Safe Working Pressure of Scotch Boiler

Q. (1153).—Please give the formula showing how to find the safe working pressure of a double ended Scotch boiler, 16 feet 9 inches long and 6 feet diameter, with triple riveted longitudinal seams, thickness of plate 1.08 inches, tensile strength 54,000 pounds per square inch.

A. (1153).—Since insufficient data have been given in the question from which to make a specific calculation, it is assumed that the boiler has already been designed and that a method only for determining the safe working pressure is desired.

According to the General Rules and Regulations of the United States Steamboat Inspection Service the working steam pressure allowable for any dimension of boilers must be ascertained by the following rule:

"Multiply one-sixth of the lowest tensile strength found stamped on the plates in the cylindrical shell by the thickness—expressed in inches or parts of an inch—and divide by the radius or half diameter, also expressed in inches, and the result will be the pressure allowable per square inch of surface for single riveting, to which add 20 percent where the longitudinal laps of the cylindrical parts of such boiler are double riveted, when all the rivet holes of such boiler, including steam and mud drums, have been fairly drilled

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and no part of such holes has been punched. The pressure allowed shall be based on the plate whose tensile strength multiplied by its thickness gives the lowest product."

Using the figures given, your problem works out as follows:

$1/6 \times 54{,}000 = 9{,}000.$
$9{,}000 \times 1.08 = 9{,}720.$
$\frac{9{,}720}{36} = 270$ pounds per square inch, for single riveting.

Add 20 percent to the above result for double riveting and the allowable safe working pressure becomes 324 pounds per square inch.

NEW BOOKS

NAVAL ARCHITECTURE. By W. M. Gray, B.Sc. Size, 5½ inches by 8½ inches. Pages, 201. Diagrams, 100. London, 1923. Methuen and Company, Ltd.

This is a new classbook on naval architecture by the lecturer on naval architecture at the Royal Technical College, Glasgow. The writer has very sensibly confined himself to the science of floating bodies as represented by buoyancy, stability and trim with a chapter on launching and one on riveted joints. Each chapter is followed by questions covering the matter dealt with, and diagrams are freely employed to explain and illustrate the text.

The various subjects have been treated in a clear and simple, as well as a thorough manner, and many students will prefer Mr. Gray's treatment to that in earlier textbooks. New and practical examples of the application of various theories are presented which will serve to stimulate the interest of students without covering too much ground.

The book is excellently printed and bound and is highly recommended for its practical value to all interested in the calculations of ship design.

THEORETICAL NAVAL ARCHITECTURE. By E. L. Atwood, O.B.E. Size, 5 inches by 7¼ inches. Pages, 512. Many diagrams, 6 folding plates. New York, 1923. Longmans, Green and Company.

This is really the eighth edition of the "Text Book of Naval Architecture" first published in 1899 and a standard work of reference in nearly every ship drawing office. But in this latest edition the name has been slightly changed and the scope very considerably increased by the inclusion of chapters dealing with speed calculations, strength, screw propulsion, steering, etc.

The earlier chapters deal concisely with the mathematics of a floating body and have undergone little change in this last edition, though where there has been a development in theory or method this has not been overlooked, as is evidenced by the treatment of Tchebycheff's rules, Smith's buoyancy correction and the use of the integrator.

There is a chapter also on the Trochoidal Wave Theory which the writer does not remember to have seen dealt with elsewhere outside of Biles' exhaustive "Design and Construction of Ships." In the chapter on Horsepower and Speed use has been made of A. W. John's curves of Residuary Resistance—a very good method but one little used, and for which little data are available. Without space to deal with the form of ships for minimum resistance any method of calculation of power is of little use, and it might have been better if the author had confined himself to explaining the forms of data now in use with their limitations.

The chapter on propellers is also much too short to deal with the matter thoroughly and might well have been omitted from a classbook of this kind.

But any criticism of the work must not detract from a very hearty appreciation of the volume as a whole, and the feeling that for many years to come this book will continue to be one of the indispensables for those who design ships.

The volume concludes with a valuable bibliography in which we notice MARINE ENGINEERING AND SHIPPING AGE finds a place.

PERSONAL MENTION

J. M. WILLIS, general manager of the Baltimore Dry Docks plant of the Bethlehem Shipbuilding Corporation, Ltd., became general manager of the Baltimore Dry Docks Works and Sparrow's Point Works, of the Baltimore plant, Bethlehem Shipbuilding Corporation, Ltd., on March 1, following the consolidation of the shipbuilding and ship repairing interests of the Bethlehem Shipbuilding Corporation, Ltd., in the Baltimore district under one local management with headquarters at Sparrow's Point, Md.

JOHN W. CANTILLION, secretary of the American Bureau of Shipping, completed twenty-five years of service with this institution on February 15, which was also the twenty-fifth anniversary of the date on which the battleship *Maine* was blown up in Havana Harbor. Mr. Cantillion joined the American Shipmasters' Association on February 15, 1898. This association was the parent of the present Bureau, the name being changed in November, 1898. At this time the staff consisted of E. Platt Stratton, chief surveyor; J. S. Ritchie, engineer and ship surveyor for steel vessels; Capt. F. A. Martin, consulting surveyor and chairman of the classification committee; Capt. Austin Jayne and Capt. B. F. Cutler, surveyors of wood vessels. While the construction of wooden vessels flourished the Bureau was very active and, when the steel ship construction increased, the staff of surveyors was also amplified. The American Shipmasters' Association, as the American Bureau of Shipping was originally known, was formed in 1862 by the underwriters, shipbuilders and shipowners and these three important branches of the maritime fraternity are still component parts of the organization and are represented in the administration of its affairs. In 1908 this organization, known as the United States Standard Shipbuilders', Shipowners' and Underwriters' Association, was amalgamated with the American Bureau of Shipping. On October 21, 1913, John W. Cantillion was elected secretary of the Bureau, in which office he has continued until the present. In September, 1915, representatives of the shipbuilders, shipowners and underwriters believed that if the Bureau was to be continued it would have to be reorganized. After careful investigation and consideration the committee having induced Stevenson Taylor to become president, the Bureau was reorganized on February 28, 1916, at a meeting of the board of managers. At this meeting Stevenson Taylor was elected president; A. C. Pessano, F. G. Macomber, L. F. Burr and W. H. Todd, vice-presidents, and John W. Cantillion secretary and treasurer. Mr. Cantillion has seen this now efficient organization grow from an infant's size

J. W. Cantillion

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with five surveyors to a full man's size organization with branch offices in the principal seaports of the United States and in Tampico, Havana, Rio de Janeiro, Buenos Aires, Balboa, Antwerp, Havre and Hamburg. To the man on the street interested in maritime matters he is known only as John, always endeavoring to aid them in obtaining the facts they desire relative to ships and carrying out the cardinal principles of the Bureau's charter, viz., to disseminate information upon subjects of marine and commercial interest and to aid and develop the American merchant marine.

H. G. SMITH, whose appointment as vice-president of the Bethlehem Shipbuilding Corporation, Ltd., in charge of sales, on January 11 was announced in our last issue, graduated from the United States Naval Academy in 1891 and from the course of naval architecture at the Royal Naval College, Greenwich, England, in 1894. From 1893 to 1903 he served in the Navy as assistant navy constructor and naval constructor, being on duty at the plant of William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pa., from 1894 to 1898 during the building of the *Indiana, Massachusetts, Brooklyn* and *Iowa,* and also during the period when the American liners *St. Louis* and *St. Paul* were under construction in that yard. From 1898 to 1901 he was on duty at the New York Navy Yard, Brooklyn, N. Y., in charge of ship repairs and the docking of vessels. From April, 1901, until November, 1903, he was on duty in Washington as assistant to the chief constructor of the Navy in charge of designs and current work. Naval Constructor Smith resigned from the Navy on November 1, 1903, and accepted the position of manager of the Fore River Ship and Engine Company, later the Fore River Shipbuilding Corporation and now the Fore River Plant of the Bethlehem Shipbuilding Corporation, Ltd. From 1913 until 1917 Mr. Smith was vice-president and general manager of the Fore River Shipbuilding Corporation and from 1917 until 1920 manager of the Bethlehem Shipbuilding Corporation, Ltd. From 1920 until his present appointment Mr. Smith was assistant to the president of the Bethlehem Shipbuilding Corporation, Ltd.

H. G. Smith

W. W. SHERLOCK, formerly associated with the Kerr Chartering Company, has now organized a ship brokerage agency with offices in the Maritime Exchange, New York.

A. W. CHRISTIAN has been appointed general sales agent of the Bethlehem Shipbuilding Corporation, Ltd., with offices at 25 Broadway, New York City, to succeed E. B. Germain, resigned.

ALBERT W. HONYWILL, JR. has severed his connections with the Terry Steam Turbine Company, at Hartford, Conn., to take up new duties as assistant to the president of the Diamond Power Specialty Corporation of Detroit.

J. O. PERSONS, SR., formerly New York representative of the Baltimore Dry Dock and Shipbuilding Company and more recently with the Shipping Board, is now representing the Maryland Dry Dock Company, Baltimore, Md., in New York.

CLOYD M. CHAPMAN has become affiliated with Dwight P. Robinson & Company, Incorporated, as consulting materials engineer. Mr. Chapman, who has been active in the work of the American Society of Testing Materials and the American Concrete Institute, will in the future represent Dwight P. Robinson & Company in the committee work of these societies.

B. H. KNIGHT has been made manager of the Ocean Traffic Bureau of Philadelphia, according to an announcement given out by the president, George F. Sproule.

J. C. JENKINS, director of industrial relations of the United States Shipping Board, has succeeded Capt. Irving L. Evans, who recently resigned, as director of the Sea Service Bureau of the Board. Mr. Jenkins will have full charge of the recruiting service.

PETER J. SHOMER, of The Shomer Company, 510 Kirby Building, Cleveland, O., has been appointed by Row & Davis Engineers, Inc., New York, as their representative in the Great Lakes District. Mr. Shomer was formerly associated with the American Shipbuilding Company, of Cleveland, O.

JOHN HUMBLE, retired shipbuilder, died on February 6 at his home in Buffalo, N. Y. Mr. Humble served an apprenticeship in the Buffalo shipyards, working on some of the first steamships built on the Great Lakes. He founded the firm of Parsons & Humble, shipbuilders, who built the largest wooden hull steamships ever used on the lakes.

A. B. BARBER, of Portland, Oregon, has been appointed manager of the Department of Transportation and Communication of the Chamber of Commerce of the United States, succeeding J. Rowland Bibbins, who has resigned to take up private engineering practice. For the past three years, Mr. Barber served as technical adviser to the Republic of Poland, having been nominated for that work in 1919 by Secretary Hoover, on request of the Polish Government to designate an American engineer to assist in the organization of the railways, coal industry and other technical services. Mr. Barber is a graduate of West Point. Prior to his resignation from the army three years ago to become head of the American technical staff for Poland, he had wide experience with the United States Army Engineers. Soon after the entry of the United States into the war, he was sent to France with a railway commission to report on the needs of the French railways supplying the Allied troops. Later he was assigned to General Pershing's staff, in connection with organization, transportation and overseas shipping. From June to November, 1918, he was at the front with the First Corps, and First and Second Armies. After the armistice, he was assigned to the American Relief Administration, handling the transportation of relief supplies to the various countries of Central Europe. The department, of which Mr. Barber is head, handles the activities of the United States Chamber of Commerce in connection with shipping, ocean and inland; steam and electric railroads, motor transportation; aeronautics and the like.

Col. A. B. Barber

CAPTAIN IRVING L. EVANS, for several years Director of the Sea Service Bureau of the United States Shipping Board, has resigned that position, according to announcement made by Commissioner T. V. O'Connor, of the Shipping Board. The Sea Service Bureau has been placed under the Division of Industrial Relations, and J. C. Jenkins, Director of Industrial Relations, will have full charge of the Recruiting Service as Director of that division of the Shipping Board.

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The Month's Shipping and Shipbuilding News in Brief

Shipyard, Steamship and Port Activities and Other Notes of Interest in All Branches of the Marine Industries

North Atlantic Ports Association Started

AT the request of Mr. F. S. Davis, manager of the maritime department of the Boston Chamber of Commerce, a preliminary conference to discuss the advisability of organizing a North Atlantic Ports Association was held in the Commodore Hotel, New York, February 6. Representatives were present from the following organizations:

Directors of the Port of Portland, Maine; Portland Chamber of Commerce, Portland, Me.; Maritime Department of the Boston Chamber of Commerce, Boston, Mass.; Providence Chamber of Commerce, Providence R. I.; New London Chamber of Commerce, New London, Conn. and State of Connecticut; Maritime Association of the Port of New York, New York City; Philadelphia Maritime Exchange, Philadelphia, Pa.; Export & Import Board of Trade, Baltimore, Md.; Baltimore Chamber of Commerce, Baltimore, Md.; Hampton Roads Maritime Exchange, Norfolk and Newport News, Va.

The meeting was called to order by Mr. Davis, who stated briefly the purposes of the conference, viz: "To consider the advisability of forming an organization representative of the North Atlantic Ports as a group, its scope, if formed, and membership, calling attention to the very effective work being done by other similarly constituted port group organizations, such as the South Atlantic Maritime Association and the Mississippi Valley Association, and the West Coast Ports Association." Mr. Davis was elected temporary chairman and Harry M. Thompson, secretary, Hampton Roads Maritime Exchange, temporary secretary.

The chairman called upon each representative for an expression of opinion as regards the purposes of the meeting and all present expressed themselves as being in the main favorably disposed towards forming such an organization which should function along broad general lines, to protect the North Atlantic Group of Ports. In the discussion, however, it developed that there existed some considerable difference of opinion as to the scope of such an organization, if formed, particularly with regard to the propriety of entering into any technical rate dispute or action.

The following resolutions were adopted:

RESOLUTIONS ADOPTED

Resolved: That it is the sense of this meeting that a North Atlantic Ports Association be formed, subject to the ratification of each organization here represented.

Resolved: "That all commercial organizations of each port on the North Atlantic, be eligible to membership in this proposed organization, excluding any such whose obligations and interest extend beyond the port."

Upon motion duly seconded and carried, the present chairman and secretary were continued until a permanent organization is effected and their successors duly elected.

No action was taken in regard to the appointment of a committee on rules and by-laws, and other committees, pending a full attendance of all organizations not represented at the first meeting, and it was agreed that haste in this phase of the matter was not desirable, but in order to accelerate matters, all present were requested to supply the secretary with a list of the names of such organizations in his port as were considered eligible, which would be consolidated and sent by the secretary to those present, with the call for the next meeting, which it was agreed, upon the invitation of the secretary of the Maritime Association of the Port of New York, would be held in the board room of the New York Maritime Exchange in about a month hence, date being left to the chairman.

Bids Open March 14 for Million and a Half Reconditioning Job on Ward Liners Orizaba and Siboney

BIDS will be received at the office of Theodore E. Ferris, naval architect and marine engineer, New York City, until March 14, for the work of reconditioning the steamships *Orizaba* and *Siboney*, of the New York and Cuba Mail Steamship Company (Ward Line). It is understood that the contract, which provides for the construction of additional deck space and deckhouse extensions, furnishings, etc., will involve a total expenditure of close to $1,500,000. The vessels are to be back in service next October.

Both ships, which were originally designed as twin screw freight and passenger steamers, have an overall length of 443 feet 3 inches, beam molded 60 feet, depth molded to shelter deck 35 feet, and are of the shelter deck type with decks as follows: boat deck, "A" deck, "B" deck, "C" deck, "D" deck, "E" deck and "F" deck. The propelling plant consists of eight single ended Scotch boilers with two firerooms; twin screws, reduction gear, turbine machinery, oil burning. The vessels were built by the William Cramp and Sons Ship and Engine Building Company.

GENERAL WORK

Both steamers are to be drydocked and undergo special No. 1 survey to Lloyds' Register of Shipping, both port and starboard tail shafts of both vessels are to be drawn for examination, the military mast located between the smokestacks is to be removed, fore and main masts are to be lengthened and new rigging fitted, as required. The after end of the boat deck is to be extended at sides and aft; "A" deck closed in, port and starboard, in way of main masts; steel deckhouses built in amidships, port and starboard; the after end of "A" deck, which was formed for depth bomb installation, to be rebuilt, including extension of docking bridge to original condition. There is also to be a new arrangement of derrick posts, booms and winches for handling cargo at the after wing ports to be installed, new canvas decks fitted, sections of new deck fitted, deck covering and tiling to be repaired, and some new to be laid.

The mechanical ventilating and heating system for passenger and crews quarters, as required where not now existing, to be installed, including motors, fans, thermo tanks, etc.; steam heat to be provided in crews' quarters and otherwise as required in accordance with the detailed specifications.

The present electric light wiring throughout the ships is to be removed down to switchboard and the ships rewired new throughout with new electric light fixtures provided, as required. The fresh water system and sanitary system are to be provided for and arranged to suit the new conditions; the communicating system, consisting of telephones and bell calls and a signal apparatus provided, as required.

The present steam windlass and steam hand steering gear are to be overhauled, and the ships are to be cleaned, scaled, painted and finished inside and out, and a sprinkling system provided, as required by the United States Steamboat Inspection Service.

MACHINERY DEPARTMENT

The propelling machinery, boilers, engine room auxiliaries and ice machine, are now and have been operating and no particular amount of work is contemplated in the machinery departments except minor work as covered in the detailed specifications, such as opening of boilers and turbines, grinding of valves, minor repairs and renewals, etc.

"ORIZABA" BOTTOM DAMAGE

In the case of this ship, following an inspection made in drydock by Lloyds' surveyors in August, 1922, after an alleged grounding in New York Bay, it was recommended at that time that permanent repairs to the bottom plating should be carried out, a summary of this damage being as follows: keel plates 9, 10, 11, 12, 16 and 17 indented; "A" strake 9, 10, 11, 12 and 13 indented; "B" strake 8, 9 and 10 indented; "C" strake 6 and 7 indented. It is understood that this particular damage is to be cared for under a separate contract.

PRINCIPAL WORK

Among the principal items mentioned in the specifications are the following:

Farrell Calls Foreign Traders to Meet in New Orleans

JAMES A. FARRELL, chairman, National Foreign Trade Council, and president, United States Steel Corporation, has called the Foreign Traders of the United States to meet at the Tenth National Foreign Trade Convention in New Orleans, May 2, 3 and 4. The central theme of the convention will be "European Conditions as Relating to World Trade."

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Deep tanks, Nos. 9, 10, 11, between frames 57 and 65, are to be entirely removed and this space is to be restored to carry cargo with the necessary number of cofferdams. The eight deep wing tanks, Nos. 1, 2, 3, 4, 5, 6, 7 and 8, and double bottom tanks, Nos. 6, 7, 8 and 9 are to be fitted with coils around suctions and heater grids in each of these tanks.

All steam and water pipes throughout the cargo and passenger spaces are to be removed and the new piping installed in accordance with detailed plans to be prepared by the contractor and approved by the owner's representative. A large amount of Lit-O-Silo is to be laid on the various decks.

THE "SIBONEY"

A similar amount of general reconditioning work is to be done on the *Siboney*, the principal items of which include the following:

The space between frames 95½ to 101 is to be cleared of berths, lockers, etc., and reconditioned as the crews' hospital, the equipment to include six metal berths. The boat deck is to be extended aft to frame 145 and carried for this length, including that portion from frame 130 to 140 to the sides of the ship.

The sides of "A" deck, from frame 130 to frame 153, are to be decked over to the sides of the ship, of the same construction as the present deck. To support this extension a steel girder is to run the full length of this portion of the deck, fastened to beams and supported by a steel tubular column resting on "C" deck, this column to be of sufficient strength to support the deck and four small booms for handling cargo, each about 17 feet long and about 3 tons' capacity.

On "A" deck the space between frames 44 to 62 is to be reconditioned and arranged for six passenger staterooms de luxe with adjoining bathrooms. While the space between frames 69 and 91, occupied at present by temporary staterooms, is to be cleared and reconditioned to form reading room, writing room and lounge.

On "A" deck, between frames 90 to 111, both sides, a new deckhouse extension is to be built each side of the main house, each of these houses to be fitted up with passenger staterooms, shower bath, etc.

On "B" deck the space between frames 42 and 52 is to be reconditioned to form suite, bedroom and bath, while that between frames 52 and 55 is to be reconditioned by installing new berths and fittings.

In addition to considerable other reconditioning work for the providing of passenger accommodations, the contract will call for the overhauling of the various mechanisms on both ships, the replacement of various systems, motors, galley equipment, etc.

Bids Asked for Construction of Semi-Diesel Electric Towboat

SEALED proposals will be received by U. S. Engineer Office, Nashville, Tenn., until 11 A. M., March 6, for the construction and delivery of one 80-foot semi-Diesel electric towboat. The vessel is to be delivered at Nashville, Tenn., and is to have a length overall of 98 feet 4 inches, length molded 80 feet, breadth molded 20 feet, depth molded 4 feet 6 inches.

MACHINERY

The main engine will be a multiple cylinder, 2-stroke cycle, heavy duty, semi-Diesel oil engine and is to be of American manufacture.

Agamemnon and Mount Vernon Committee Submits Recommendations

THAT extensive reconditioning contracts on the steamships *Agamemnon* and *Mount Vernon* are drawing materially nearer is indicated in latest information obtained by MARINE ENGINEERING AND SHIPPING AGE. It was announced in these columns on December 9, 1922, that a committee of prominent shipping men had made an investigation of the ships and preliminary estimates of the reconditioning cost were given out.

It was recently learned that the committee's report has been completed and forwarded to Washington and while no official statement could be obtained it is believed that these two great ships will be converted either into passenger ships or as seaplane carriers.

Reconditioning of the *Agamemnon* and the *Mount Vernon* as passenger ships would probably reach a total cost of close to $5,000,000. No estimates could be obtained on their conversion as aeroplane carriers.

Bids for Reconditioning of America Due Early in March

ACCORDING to the latest information available, it is believed that plans and specifications for the reconditioning of the steamship *America* will be issued from the Shipping Board, 45 Broadway, New York, about March 2, bids to be received a week later. The contract will involve the expenditure of close to half a million dollars. It is understood that the ship will be placed in drydock in New York for necessary bottom work so that in the event of the contract being placed in another city the ship will proceed direct from New York Harbor.

The *America* has an overall length of 687 feet and it is expected that after her conversion she will be the largest cabin carrier in the world. Specifications will cover reconditioning of the hull and machinery, the rearrangement of present and installation of additional public rooms; overhauling the present, and wherever necessary, the installation of new systems such as ventilating, heating, electric, sanitary, etc.

New York and Porto Rico Line Ship Specifications Issued

PLANS and specifications for the construction of a passenger and cargo ship for the New York & Porto Rico Line have been issued from the office of Theodore E. Ferris, naval architect, 30 Church street. Bids will be received at that office until 12 o'clock noon, March 20, and it is believed the cost will be in excess of a million and a half dollars.

The proposed ship will have an overall length of 428 feet 3 inches; length between perpendiculars, 412 feet; beam, molded, 57 feet 6 inches; depth to hurricane deck at side, 36 feet 6 inches; designed load draft, 23 feet 6 inches; deadweight capacity at load draft, 4,250 long tons; speed at load draft, 15½ knots.

TYPE OF SHIP

The vessel will be of the three-deck, hurricane deck, coastwise type with forecastle, deck well, bridge enclosure and continuous deck erections aft; complete double bottoms; lower, main, hurricane, promenade and boat decks, and two steel pole masts.

PROPULSION

The propelling machinery will consist of a Parsons design turbine engine, with reduction gears turning a single screw. At 87 revolutions per minute, the shaft horsepower will be about 5,800. Steam will be supplied by five Scotch boilers, equipped to burn oil for fuel.

EQUIPMENT

The steamer's accommodations will be sufficient for 305 first class passengers and 82 second class.

A separate price will be submitted by bidders for the installation of an air cooling refrigerating and insulation system capable of cooling practically all of the ship's cargo space for the carrying of citrus fruits.

Annual Motor Boat Show Opened in New York

THE annual National Motor Boat Show, which is being held at the Grand Central Palace, New York, from February 21 to March 3, gives yachtsmen an opportunity to inspect a complete display of power driven craft, ranging from an eight-foot Kiddie Kanoe to a sixty-foot ocean cruiser.

Several important meetings are scheduled in New York during the period of the show, including those of the United States Power Squadrons, the Waterway League of America, the American Power Boat Association, the Society of Automotive Engineers, the National Association of Engine and Boat Manufacturers, the International Power Boat Union and the Mississippi Valley Power Boat Association.

The show is held under the auspices of the National Association of Engine and Boat Manufacturers.

University of California Offers Instruction on Ships and Shipping

THE University of California Extension Division has organized class instruction in San Francisco, on ships and shipping. Charles F. Gross, assistant professor of marine engineering and naval architecture at the University, is the instructor of the first course along this line which has been attempted. Many prominent men in shipping circles have enrolled and the class recently organized already totals nearly 100.

The first course is an elementary one, and consists of ten 1½-hour lectures on such subjects as types and classification of merchant vessels, relations between different tonnages, stability, manning requirements, wages and duties of crews. The instruction will also include a brief description of marine power plants.

Plans are now being laid for more advanced courses on the completion of the present one covering ships and shipping.

British Naval Architects to Hold Annual Meeting March 21-23

THE annual meeting of the Institute of Naval Architects will be held on March 21, 22 and 23, in the Lecture Hall of the Royal United Service Institution, Whitehall, London, W. C., 2, with His Grace the Duke of Northumberland, C.B.E., M.V.O., president, in the chair. The annual dinner will be held on March 21 at 7:30 P. M. in the Grand Hall, Connaught Rooms, Great Queen street, Kingsway, London, W. C.

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Electric Contract for Diesel Barges Goes to G. E. Co.

THE General Electric Company has been awarded a contract for the electric equipment to be used on the two Diesel-electric, self-propelled barges, which have been ordered by the Minnesota All-Water Transit Company, of Duluth, from the Great Lakes Engineering Works. The equipment of each barge will consist of two Lombard-Governor Diesel engines, directly connected to a 250-kilowatt, direct current generator, which in turn will supply electricity to drive two 250 horsepower motors, one attached to each of the twin screws. The motors are rated at 180 revolutions per minute, which will give the barges a speed of approximately eight knots.

The vessel will be controlled from the pilot house. They were designed by Henry Penton, of Cleveland, and will have a length of 254 feet and beam of 42 feet.

Navy Department in Need of Draftsmen for Small Boat Work

The United States Civil Service Commission announces an open competitive examination for ship draftsmen, Grade A (small boats). Vacancies in the Bureau of Construction and Repair, Navy Department, Washington, D. C., at $6.80 to $8.80 per diem (plus bonus), and vacancies in positions requiring similar qualifications, at these or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

Appointees at annual compensation of $2,500 or less, whose services are satisfactory, may be allowed the increase of $20 a month granted by Congress.

Marine Examinations

The United States Civil Service Commission announces an open competitive examination for junior engineer and deck officer. Vacancies in the United States Coast and Geodetic Survey, at the entrance salary of $2,000 a year, and in positions requiring similar qualifications, at this or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion. Applications will be rated as received until June 30, 1923. Successful applicants will be notified.

Bids Received on February 24 for Construction of Two Barges and a Steel Quarter Boat

BIDS were opened at 11 A. M., February 24, by United States Engineer Office, Wilmington, Del., for the construction and delivery of one steel quarter boat and two steel barges.

The quarter boat is to have a length of 80 feet, beam molded 26 feet, depth molded 5 feet, and is to be a 34-man vessel. The equipment for the vessel is to include a steam engine generating set, generator rated at three kilowatts, 110 volts, 700 revolutions per minute; fresh water pressure system, sanitary system, hot water pressure system and complete sets of plumbing fixtures of heavy type Sands, Standard, Mott, or equal. A fire and bilge pump, 4½ inches by 5 inches by 6 inches, Davidson Simplex, or equal; and a sanitary pump, 5¼ inches by 5 inches by 6 inches, Worthington, or equal, are also to be installed.

The steel barges are to have a molded length of 60 feet, beam molded 22 feet, depth molded 4 feet. Each barge is to have two transverse watertight bulkheads and is to be fitted with four 7-inch cast iron bitts of approved design.

The quarter boat and barges are to be delivered afloat, at A and Poplar Streets, Wilmington, Del.

America's Foremost Shipping Men Address Propeller Club of the Port of New York at Noon-Day Luncheon

WHAT the Shipping Board is doing for the promotion of a sussessful American Merchant Marine was the theme of an address by Joseph E. Sheedy, vice-president of the Emergency Fleet Corporation, at a meeting of the Propeller Club of the Port of New York, on February 23. The results of the Board's policies, Mr. Sheedy stated, will be advantageous to American shipping, irrespective of the fate of the subsidy bill.

Commenting on the $138,000,000 budget for the Board this year, Mr. Sheedy said that the principal items of expense for ship operation are as follows: fuel, 28 percent; stevedore and cargo handling, 23 percent; port charges, 10 percent, repairs, 12 percent and wages, 12 percent.

Other speakers included Stevenson Taylor, president of the American Bureau of Shipping; R. D. Gatewood, director of the Division of Maintenance and Repairs, of the Shipping Board; Captain W. E. Griffith, operating manager; and Captain C. A. McAllister, vice-president of the American Bureau of Shipping.

All of the speakers spoke in high praise of the Propeller Club, the object of which is promotion of the "get-together" spirit, through informal luncheon meetings held twice a month. Its officers are:

W. Z. Gardner, president; J. Bonner, vice-president; H. W. Parsons, treasurer; B. L. Todd, secretary; Norris R. Sibley, of the London Steam Turbine Company, chairman membership committee; S. L. Lemon, of the W. A. Harriman Company, chairman executive committee.

Two Ferryboats Contemplated

THE Westchester Ferry Company, represented by the Mercury Shipping Company of 17 Battery Place, New York City, through Leo E. Schwarstein, is taking up with various shipyards the question of the construction of two ferryboats to run across the Hudson river in the vicinity of Yonkers.

Shipyard Expansion

The George T. Johnson & Sons' construction and repair yard, Cambridge, Md., is expanding its facilities through the installation of a new marine railway and various new machinery, having recently completed other improvements. The plant constructs yachts, lighters, barges and tugs and is at present building a twin screw houseboat for Charles V. Bossert, of Brooklyn, N. Y.

International Conference

The subject of "National Restrictions on Maritime Transportation" will be one of the topics discussed by group sessions at the second general meeting of the International Chamber of Commerce to be held in Rome, Italy, March 18 to 24. A. C. Bedford is chairman of the American committee and the American delegation headquarters will be at the Grand Hotel, Rome.

Over Two and One-Half Million Dollars' Worth of Port Improvements Contemplated by New Orleans, La.

OVER two and one-half million dollars is expected to be spent for port improvement enterprises at New Orleans, La., in the near future, according to information obtained by MARINE ENGINEERING AND SHIPPING AGE. Pier work, freight sheds, dredging, etc., are among the projects under consideration.

Among other things, plans and specifications, which are waiting approval, provide for the construction of new wharves, sheds, etc., at the foot of Claiborne Street, at a cost estimated at $1,800,000; for the renewing of about 400 lineal feet of wharves with steel structure freight sheds at the foot of Poland Street, to cost approximately $275,000; and for the reconditioning and extension of sheds at the foot of Celeste Street, which will cost close to $200,000, and the foot of St. Joseph and St. Andrews Streets, at approximately the same cost for each location. Plans and specifications have also been prepared for enlarging of sheds and improvement of the sewerage and drainage systems at the foot of Canal Street.

These projects are under the jurisdiction of the Board of Port Commissioners who will receive sealed proposals at their office, Suite 200, New Court Building, until 3 P. M., February 1, for furnishing 50,000 cubic yards of sand, delivered at the Industrial Canal site, New Orleans, La.

The same office will open at 3 P. M., on February 1, tenders for furnishing and renewing woodwork for the 7th Street shed.

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Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Barge Repairs, Philadelphia, Pa.—The damaged barge Theodore H. Rodhe was towed to Philadelphia for repairs.

Steamer Drydocked, Portland, Ore.—Steamer West Keats was awarded the Helser Iron Works for collision damage repairs.

Storm Damage Job, Winslow, Wash.—The storm-battered barkentine James Tuft was taken to Winslow, Bainbridge Island, for repairs.

Ship Drydocked, Mobile, Ala.—The tanker Mary Luckenbach has been placed on the dock at the Todd plant, Mobile, for overhauling.

Extensive Repairs, Baltimore, Md.—The H. E. Crook Company received the contract for extensive repairs to the Old Bay liner Alabama.

Repairs to Plates, Cleveland, O.—Steamer Quincy A. Shaw has been placed on No. 1 drydock, Cleveland, to have nineteen damaged plates repaired.

Steamer Reconditioned, Algiers, La.—The Shipping Board steamer West Hardaway has been placed on drydock at Algiers to be reconditioned.

Tanker Repairs, Mobile, Ala.—The Danish tanker Gedania has been placed on the drydock of the Alabama Dry Docks plant for considerable repair work.

Steamer Drydocked, Buffalo, N. Y.—Steamer Harvey D. Goulder was drydocked at Buffalo to have seventeen plates removed and thirteen faired in place.

Drydocking and Hull Cleaning, San Francisco, Cal.—The dreadnaught Arizona was taken to San Francisco to be drydocked and to have her hull cleaned.

Extensive Overhauling, Seattle, Wash. — The steamship Victoria, of the Alaska Steamship Company, has undergone an extensive overhauling and remodeling.

Engine Repairs, Chester, Pa.—The Sun Shipbuilding Company has been awarded repairs to main engine on the Vacuum Oil Company's motorship Brammell Point.

Reconditioning, Brooklyn, N. Y.—Steamer American Legion, of the Munson Line, was awarded to the Atlantic Basin yard, to be reconditioned at a cost of $8,894.

Barge Overhauled, Galveston, Tex.—The whaleback barge Freeport Sulphur No. 4 was awarded to the Galveston Dry Dock & Construction Company to undergo an overhauling.

Motorboat Conversion, New Orleans, La.—The Johnson Dry Dock and Ship Repair plant has been awarded the contract to convert the gasoline motorboat Paul to a steamboat.

Tanker Contract, East Oakland, Cal.—The Hanlon Shipbuilding and Dry Dock Company was awarded repairs on the tanker Tustem of the United States Shipping Board, at a price of $688.20.

Contract Awarded, Galveston, Tex.—The Galveston Dry Dock & Construction Company was awarded the contract for repairs to the damaged steamer Schoodic, at a price of $27,450.

Additional Vessels.—The Robert Dollar Company has purchased the British steamship Wayfarer, 15,000 deadweight tons, and the steamship Warszawa from the Polish Navigation Corporation.

Contract Awarded, Brooklyn, N. Y.—The contract for repairing the tanker H. M. Flagler, of the Standard Oil Company, was awarded the Morse Dry Dock & Repair Company, on a bid of $11,841.

Tug Launched, Brooklyn, N. Y.—The first of three steel tugboats building for the New York Central Railroad, Tug No. 30, was launched from the Tebo plant of the Todd Shipyards Corporation.

Yacht Reconditioning, New Bedford, Mass.—The seagoing yacht Harpoon, owned by Nathaniel O. Goode, is to be fitted with two high-powered inclined engines, Fayette type. Cost about $100,000.

Low Bidders, Oakland, Cal.—The Moore Drydock Company was low bidder on a big general overhauling job on the engines and boilers of the Pacific Mail liner President Taft, with a price of $18,865.

Repairs and Painting, Baltimore, Md.—The Baltimore Dry Dock Company has completed painting and repairs on the steamer Santa Rosa and has started work on the Shipping Board steamer Capulin.

Overhauling of Vessel, San Francisco, Cal.—The Bethlehem Shipbuilding Corporation was awarded the work of overhauling the Admiral Line steamer Senator, the work including refitting and changing of staterooms.

Cleaning and Painting, Portland, Ore.—The contract for repairs to the propeller and cleaning and painting the hull of the steamship Kentuckian has been awarded the Helser Iron Works, Portland, at a price of $5,000.

Barkentine Damaged.—The five-masted barkentine Molfetta, which hit on a sand spit while sailing up the mouth of Pensacola harbor, Fla., was found to have been damaged, and has been dry-docked in Pensacola for repairs.

Oil Barge Construction, San Pedro, Cal.—The Associated Oil Company has awarded the contract for the construction of a steel oil barge to the Los Angeles Shipbuilding and Drydock Corporation, to cost approximately $45,000.

Vessel Remodeling, Sparrows Point, Md.—Steamer Mary Weems, of the Baltimore & Carolina Steamship Company, will be reconditioned and remodeled at the Sparrows' Point plant of the Bethlehem Shipbuilding Corporation.

Tanker Launched, Chester, Pa.—The American tanker Pennsylvania Sun, built for the Sun Oil Company by the Sun Shipbuilding Company, Chester, has been launched. The ship is 480 feet long with a beam of sixty-five feet.

Barge Construction, Los Angeles, Cal.—The Los Angeles Shipbuilding & Drydock Corporation has been awarded the contract for the construction of a steel oil barge for the Associated Oil Company. Approximate cost, $45,000.

Contract Awarded, East Oakland, Cal.—The Hanlon Shipbuilding and Drydock Company was awarded the steamer Stanley Dollar, recently purchased from the Robert Dollar Steamship Company by R. Chamberlain, for reconditioning.

Repairs to Steamer, Oakland, Cal.—The White Flyer Line steamer Humboldt was placed on the Moore drydock to undergo extensive reconditioning, work including rebuilding of hull and superstructure and installation of a new deck aft.

Repairs to Steamers, Baltimore, Md.—The Shipping Board awarded electric work on the steamer Winston-Salem to Mason & Roe at $950, boiler work to the Pioneer Service Corporation at $1,020, and machinery repairs to Theodore H. Rhode, Inc., at $3,843.

Tug Launched, Brooklyn, N. Y.—New York Central Tug No. 31 was launched at the Tebo plant of the Todd Shipyards Corporation, this vessel being the second of three steel tugs constructed by the Todd Corporation. All are equipped with Todd oil burners.

Engines Supplied, Auburn, N. Y.—McIntosh and Seymour, of Auburn, N. Y., have been awarded the contract to supply the twin internal combustion engines of 600 horsepower, reversible Diesel type, for the Canadian Pacific ferry, to ply between Bellingham and Vancouver Island, which is now being built by Yarrows of Esquimalt.

Overhauling of Steamship, New Orleans, La.—The steamship San Ramon, recently sold to the Donovan Lumber Company, of Aberdeen, Wash., by the New Orleans Coal and Bisso Towboat Company, has been overhauled and put in condition by her former owners.

Seagoing Vessels Contracted For, United States.—There were thirty-one seagoing steel vessels, having a total gross tonnage of 165,695, building and contracted for in the United States on January 1, 1923, according to statistics compiled by the American Bureau of Shipping.

Rivet Replacements, Oakland, Cal.—The Moore Drydock Company received the contract for making repairs to the damaged steamer Celtic Prince, which consisted largely of replacement of damaged rivets, the work being done by aid of divers 25 feet beneath the surface of the bay.

Radio Contracts, West Coast.—The Alaska Packers' Association is reported as having contracted with the Radio Corporation for the installation of radio sets on the ships Star of Russia, Star of Italy, Star of France, Arapahoe, the barks Edward Sewell, Star of Scotland, and the steamer Chilkat.

Chain Contract Award, Cleveland, O.—The National Malleable Castings Company has been awarded a contract for equipping five new 600-foot freighters now under construction at the Lorain Yard of the American Shipbuilding Company. Each boat will be equipped with two 90-fathom lengths of 2¼-inch Naco chain.

Miscellaneous Repairs, Mobile, Ala.—Steamship Bethelridge was placed on the dock of the Alabama Dry Dock & Shipbuilding Company for scraping and painting, after which she was moored at the Pinto north wharf of the plant where repairs to her steam lines, electrical system, fuel oil pumps and boiler room were completed.

Ferry Contracts, West Coast.—The contract for building two ferries for the Long-Bell Lumber Company has been awarded the St. Helens Shipbuilding Company. These ferries will operate between Longview, on the Washington side of the Columbia, and Ranier, Ore. The boats will be equipped with Diesel engines and will have a length of 120 feet.

Steamer Overhauled, Sparrows Point, Md.—The steamship Columbia, being overhauled by the Bethlehem Shipbuilding Corporation, at Sparrows Point, will be renamed the City of Atlanta, when she leaves the plant. The work included overhauling of engines and boilers, installation of a number of staterooms and bathrooms, and the whole redecorated.

Steamer Launched, Lorain, O.—Steamer Joshua A. Hatfield, building for the Pittsburg Steamship Company, has been launched at the Lorain yard of the American Shipbuilding Company. The vessel is 600 feet over all, 580 feet keel, 60 feet beam, 32 feet deep. The steamer will have a triple expansion, reciprocating engine with cylinders 24½ by 41 by 65 inches, with 42-inch stroke.

Shipyard Activities, West Coast.—The Hanlon shipyards have delivered the army quartermaster's department water barge El Aguador, after installing a new wheel and drawing her tail shaft, as well as other repairs. The Standard Oil tanker Tachee was placed on Hunter's Point drydock to undergo the placing of a new rudder stock and to have her tail shaft drawn. The Pacific Mail liner Ecuador has been placed on the Bethlehem ways to have several of her bottom plates renewed.

Contracts Awarded, Mobile, Ala.—The Alabama Dry Dock & Shipbuilding Company has received the following contracts: steamer Hancock County, to be fitted out for passenger accommodations and for repairing and refinishing of captain's and chief officers' rooms; Mexican steamship Santa Alicia, plate

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work, woodwork, machinery jobs and repairs to entire bridge deck; junior mine planter Major Albert G. Jenkins, cleaning, painting and minor repairs; and tug John W. McKie, installation of rudder and propeller, and miscellaneous repairs.

Contracts Awarded, Mobile, Ala.—The Alabama Dry Dock & Shipbuilding Company, of Mobile, Ala., was awarded the following contracts: installing of new tail shaft and wheel to steamship Yumuri, of the Ward Line; repairs to the Saugerties, of the Tampa Interocean Steamship Company; drydocking for inspection and repairs to the steamship Dirigo, of the Texas Company; fitting out cabins for additional passengers and other minor repairs to the steamship Lake Fairport and bottom calking, scraping and painting to the four-masted schooner Alpena.

Conversion, Brooklyn, N. Y.—With the conversion of the steamships Santa Marta and Zacapa, now at the plant of the Robins Dry Dock & Repair Company, the United Fruit Company will complete its program of converting all steamships, operating out of the Northern Division, from coal to fuel oil burners. The United Fruit Company's fleet, equipped for burning oil by the Todd Shipyards Corporation, includes the following vessels: Toloa, Calamares, Pastores, Tivives, Carrillo, Metapan, Santa Marta, Zacapa, San Jose, San Mateo, Limon and Esparta.

Contract Awarded, Sparrows Point, Md.—The Bethlehem Shipbuilding Corporation, Sparrows Point, received the contract for the construction of two passenger steamers for the Eastern Steamship Lines, Inc., of Boston, Mass. Approximate total cost, $3,600,000. Deliveries provided for April and May, 1924. Each vessel will have length overall of 402 feet, length between perpendiculars 385 feet, beam over guards 72 feet 6 inches, load draft 16 feet 6 inches. They will be twin screw, turbine driven, oil burning, have a nominal speed of 17 knots and 5,310 tons displacement; night boats for service between New York and Boston, operating through the Cape Cod Canal.

PORT IMPROVEMENTS

Navigation, Etc., Orange, Tex.—$750,000 has been voted by Orange County, Tex., for navigation improvements on Sabine River.

Ferry Docks, Windsor, Ont.—New docks are planned at Windsor by the Detroit Windsor Ferry Company at a cost of $500,000.

Electric Crane, Ogdensburg, N. Y.—The Hall Coal Company is planning to replace the electric crane destroyed by storm last season. Price $40,000.

Harbor Improvements, Houston, Tex.—Harris Company and the City of Houston have voted $4,000,000 bonds for harbor and dock improvements. J. C. McVea, city engineer.

Grain Elevator, Etc., Goderich, Ont.—Goderich Elevator & Transit Company, Horton street, London, is having plans prepared for a grain elevator, $250,000, and also improving harbor $250,000.

Grain Elevator, Burrard Inlet, B. C.—A grain elevator on 150 by 1,650 foot site, at Burrard Inlet, is being planned by E. A. Woodward Grain Company, Ltd., 721 Grain Exchange, Winnipeg, Manitoba. Price $500,000.

Grain Elevator, Duluth, Minn.—Occident Elevator Company, Board of Trade Building, plans a 6-story, 200 by 250 foot grain elevator of reinforced concrete, on pile and concrete foundation, at Rices Point, to cost $900,000.

Contemplated Improvements, New Orleans, La.—Over two and one-half million dollars is expected to be spent for port improvement enterprises at New Orleans, La., in the near future. Pier work, freight sheds, dredging, etc., are among the projects under consideration.

Grain Elevator, Ft. William, Ont.—James Stewart Grain Company had plans prepared for a 1,500,000 bushel terminal grain elevator, concrete, $850,000. The pile foundation was awarded to the Thunder Bay Harbor Improvement Company, Molsons Bank Building, Port Arthur, at $150,000.

Pier, San Diego, Cal.—The United Dredging Company, foot of Beech street, was awarded the contract for 305,000 cubic yards of dredging at $0.295 per cubic yard, 12,000 ton rock fill at $2.70, constructing curtain walls, etc., at $87,525, by the Common Council constructing first unit of mole type pier No. 2.

Excavation, Fort Pierce, Fla.—Excavation in the North St. Lucie river drainage district, during the month of December, totaled 206,772 yards, according to the monthly report of operations. This brings the total excavation up to nearly four million yards, or about two-thirds of the total project, which it is estimated will be completed in another year. The monthly excavation in the district is again approaching normal, after several months of hindrance on account of high water.

Drainage Projects, Tallahassee, Fla.—Five new drainage projects, contemplated by the Everglades drainage board for the coming year, have been approved, it was announced by F. C. Elliott, chief engineer of the board, upon his recent return to the capital from South Florida. They include construction of an intercepting canal, at a point fourteen miles south of Lake Okeechobee, east of Hillsboro and North New River canals; and construction of levees on the West Palm Beach and Miami and South New River canals.

GOVERNMENT WORK

Dredging, New York, N. Y.—U. S. Engineer, 1st District, plans dredging at Flushing Bay.

Dredging, New York, N. Y.—U. S. Engineer, 2nd District, plans to dredge in Shrewsbury River.

Waterway Dredging, Galveston, Tex.—U. S. Engineer, Galveston, plans dredging Sabine-Neches Waterway.

Dredging, Providence, R. I.—U. S. Engineer, Providence, plans maintenance dredging in Connecticut River.

Harbor Improvement, New Orleans, La.—U. S. Engineer, 329 Custom House, plans to dredge Intercoastal Waterway, near Houma.

Derrick Boats, Etc., Nashville, Tenn.—U. S. Engineer is planning to purchase 2 steel derrick boats and 9 barges for revetment work.

Maneuver Boat, Savannah, Ga.—U. S. Engineer Office, plans to purchase a maneuver boat for Dam 30, Ohio River, also plans repairs to dredge Macon.

Dredging, San Diego, Cal.—United Dredging Company, Exposition Park, Los Angeles, received the contract for dredging in San Diego Harbor. Price $103,676.

Rip-rapping Dike, Mare Island, Cal.—Specification 4775—Bureau of Yards & Docks, Navy Department, Washington, D. C., is planning rip-rapping dike, Mare Island.

Pier, Etc., Boston, Mass.—Specification 4778—Bureau of Yards & Docks, Navy Department, Washington, D. C., plans fuel oil pier, bulkhead and dredging, at Boston.

Reconstructing Dikes, Mare Island, Cal.—Specification 4776—Bureau of Yards & Docks, Navy Department, Washington, D. C., plans reconstructing dikes 9 and 14, Mare Island.

Barges, Milwaukee, Wis.—U. S. Engineer, Federal Building, awarded contract for five barges and installation of machinery in same, to Greenbay Dry Dock Company, Greenbay, Wis., at $72,400.

Crane, Washington, D. C.—The Chief of Engineers Office, 250 Old Land Office Building, has awarded the contract for one steam locomotive crane to McMyler-Interstate Company, Bedford, O. Price $5,870.

Lock Gates, Pittsburgh, Pa.—John Eichleay, Jr., Co., 45 South Twentieth street, was awarded the contract by the U. S. Engineer, Pittsburgh, for steel lock gates for Lock 1, Allegheny River, at a price of $7,371.

Excavating, Wilmington, Del.—The Delaware Dredging Company, 139 South Third street, Philadelphia, Pa., was awarded the work of excavating cut-offs in St. Jones and Mispillion Rivers, by U. S. Engineer. Price $45,632.

Contract Awarded, Buffalo, N. Y.—The American Construction Company, Marion Building, Cleveland, Ohio, was awarded the contract for constructing a stone and concrete superstructure on breakwater in Buffalo Harbor, at a price of $447,609.

Pier Extension, Puget Sound, Wash.—Specification 4707—Bureau of Yards and Docks, Navy Department, Washington, D. C., awarded a contract to Henry & McFee, 208 Northern Life Building, Seattle, for extension to pier, Puget Sound, at a price of $395,173.

NEW INCORPORATIONS

Great Central Forward Company, of New York, capital $12,000, chartered under Delaware laws.

The New York Port Terminal Company, capital $1,000,000, to build docks, chartered under Delaware laws.

Fort Myers Steamship Company, Fort Myers, Fla., capital $100,000. President, I. W. Riggs; secretary and treasurer, Harry Botts.

The Canadian-American Bureau of Trade, of Manhattan, shipping agents, capital $20,000, chartered at Albany. Incorporators: E. B. Beacham, D. W. Harris and T. R. Fleming.

Polarus Shipping Company, ship brokers, capital $125,000, incorporated under Delaware laws. Incorporators: Captain T. N. Agapeyeff, Marcel Levy and Charles Dunaif, of New York.

Porto Rican American Steamship Corporation, capital $2,000,000, to do business in coal and timber, chartered in Delaware. Incorporators: Wm. H. Stayton, Sr., Wm. H. Stayton, Jr., and Arthur J. J. Townsend, of Baltimore.

FOREIGN ACTIVITIES

Shipyard Reopened, Ireland.—After having been closed for some months, the yard of the North of Ireland Shipbuilding Company, Ltd., Londonderry, has been reopened.

Contract Placed, Belfast, Ireland.—An order has been placed with Workman, Clark & Company, Ltd., Belfast, for the construction of a large passenger and cargo steamer for the Eastern trade.

New Vessel, Scotland.—The Ailsa Shipbuilding Company, Ltd., Troon, has received an order from Messrs. William Sloan & Company for the construction of two steamers, each of about 1,130 tons gross, similar to the Findhorn and the Annan, built at Troon for the same owners in 1903 and 1907, respectively.

Tonnage Output, British Company.—The Shipyards of Swan, Hunter & Wigham Richardson, Ltd., show a tonnage output during 1922 of 119,652 tons. This figure includes only ships launched on the Tyne and at yards on the Wear, on the Clyde and in Ireland, exclusively owned by the firm, and is the largest output of any British shipbuilding company.

New Steamer, Italy.—The steamer Laura, built at Cantiere Navale Triestina di Navigazione, has been successfully launched. She has a gross tonnage of 6,131; net tonnage of 3,718; length of 127.44 meters; breadth, 16.47 meters; draught, 10 meters. The vessel has engines of 2,200 horsepower, which will give a speed of 10½ nautical miles per hour.

Spanish Steamer Trials.—Having passed successful trials, the light cruiser Reina Victoria Eugenia, built at Ferrol Dockyard, has been handed over to the Spanish Government. She displaces 5,590 tons, is 462 feet long overall, 50 feet beam, 15 feet 9 inches mean draft, and has a speed of 26 knots. She has twelve Yarrow type coal-fired boilers, and her Parsons turbines develop 25,500 shaft horsepower, on two shafts.

Vessel Construction for Sweden.—According to announcement by the Swedish-American Steamship Line, which operates a fleet of passenger and freight vessels between New York and Gothenburg, an order is to be placed in a British yard for a new 16,000 gross ton liner. The ship will be 580 feet long with a 70-foot beam, and will accommodate 100 first, 400 second, and 1,000 third-class passengers. Delivery, 1924.

Contracts Placed, Rotterdam, Holland.—C. Van Der Giessen & Zonen's Scheepswerven, of Rotterdam, have received the following contracts. One motor vessel for river trade, to carry passengers and cattle, for Dutch owners, having a Bolnes 4-cylinder motor of 260 horsepower, the boat being 148 feet by 23 feet by 8 feet; and a shelter deck cargo steamer of 6,600 tons deadweight, for Dutch owners, having triple expansion engines furnished by Rotterdam Drydock Company, the vessel being 360 feet 6 inches by 50 feet by 32 feet 6 inches.

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Progress Being Made on $3,000,000 Port Development

NORFOLK, Va., January 25.—Work on the new $3,000,000 coal pier of the Virginia railway, for which contracts were awarded two months ago on which construction was immediately started, has made substantial progress.

Sanford & Brooks have been engaged in piling for the pier and in building a bulkhead since the week after the contracts were let. The bulkhead is now about three-fourths finished.

TRADE PUBLICATIONS

AIR FILTERS.—A new edition of the Midwest Steel and Supply Company (New York) catalog, covering the apparatus made by this company for handling dirt and dust problems, and air filtration for industrial plants, will be distributed within a short time.

BOILER CAPACITY.—A folder outlining three features of Heine boilers—economy, flexibility and capacity—has been distributed by the Heine Boiler Company, St. Louis, Mo. An installation of oil-fired Heine boilers, in which these features accomplish excellent results in cutting down cost, is given as a notable example.

INDUSTRIAL LIGHTING.—A new series of six bulletins on systems of lighting for various industrial uses has been issued by the Edison Lamp Works of the General Electric Company, Harrison, N. J. These bulletins cover the lighting of textile mills, pulp mills, woodworking plants, street lighting and the like. Former issues of lighting bulletins have been revised and brought up to date and may be obtained upon request

CONICAL MILLS.—Conical ball and pebble mills and their application to the field of grinding and pulverizing are described in catalog No. 13 issued by the Hardinge Company, New York. The various methods of grinding for metallurgical purposes, the manufacture of cement, and in the fuel field are taken up in detail with an illustrated description of the construction of Hardinge mills and their applications. Specifications and applications of these mills are included in the bulletin.

SEAMLESS BOILER TUBES.—The manufacture, properties and uses of "Shelby" seamless hot rolled boiler tubes are detailed in Bulletin No. 12 of the National Tube Company, Pittsburgh, Pa. One of the most important uses for seamless steel tubing is in boilers and until late years cold drawn tubes were found more satisfactory than those made by other processes. However, the process of hot rolling has been so far developed that tubes made by this process are becoming more generally used. Tables of properties of "Shelby" tubes and other useful data are contained in the Bulletin.

PUMPS AND GEARS.—The Waterbury hydraulic variable speed gear, as applied to ship's deck auxiliaries and the Waterbury variable delivery pump used for ship's steering gears are illustrated and described in bulletins sent out by the Waterbury Tube Company, Waterbury, Conn. In driving winches, capstans, windlasses and other deck machinery where electricity is available, the introduction of the Waterbury speed gear between the motor and driving gear enables extreme flexibility. The electro hydraulic steering gear combines the advantages of the hydraulic steering gear with the efficiency and adaptability of electricity as a power source.

PIPE PRODUCTS.—The products of the Whitlock Coil Pipe Company, Hartford, Conn., consisting of apparatus formed from pipe and tubing, or parts so formed, are described in a conveniently referenced pamphlet issued by this company. The products are divided into four classes—bent and welded piping for high pressure steam and fluids, coils of pipe and tubing which are made continuous by welding or brazing together the required number of pieces, welded receivers for storing fluids under high pressure and tubular heat exchanging devices including many types of heaters and coolers for different purposes.

CENTRIFUGAL PUMPS.—Small single stage centrifugal pumps for motor or belt drive are described in a bulletin and an instruction manual issued by the De Laval Steam Turbine Company, Trenton, N. J. These pumps are made in 1½-inch and 2-inch sizes and are designed for capacities ranging from 5 gallons per minute against a 10-foot head up to 130 gallons per minute against a head of 150 feet. The bulletin contains complete tables and instructions for selecting pumps to meet different conditions and also explains methods of determining the proper speeds, the manner of selecting piping, valves, fittings and the most desirable type of drive, either pulley or motor, in order to secure an efficient and satisfactory installation.

FUEL OIL BURNERS.—The Morse fuel oil burning system and the combustion engineering service of the Morse Dry Dock and Repair Company, Brooklyn, N. Y., are detailed in a well illustrated catalog recently issued. By means of an outline of the work of the designers, D. J. Irish, and the advisory engineering staff of combustion specialists, together with the drawings and photographs showing the actual construction of the system, an excellent idea of the system and the efficiency obtained by its use are given. In addition, the permanent follow-up service which is provided with each installation insures the best results with this equipment in operation. For convenient reference there are included valuable tables relating to oil burning and boiler products.

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Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

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